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COMMITTEE ON THE PEACEFUL
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Scientific and Technical Subcommittee
Thirty-fifth session
Vienna, 9-20 February 1998

REPORT OF THE SCIENTIFIC AND TECHNICAL SUBCOMMITTEE ON THE WORK OF ITS THIRTY-FIFTH SESSION

INTRODUCTION

1. The Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space held its thirty-fifth session at the United Nations Office at Vienna from 9 to 20 February 1998 under the chairmanship of Dietrich Rex (Germany).

2. Representatives of the following Member States attended the session: Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Burkina Faso, Canada, Chile, China, Colombia, Czech Republic, Ecuador, Egypt, France, Germany, Greece, Hungary, India, Indonesia, Iran (Islamic Republic of), Iraq, Italy, Japan, Kazakhstan, Kenya, Malaysia, Mexico, Morocco, Netherlands, Nicaragua, Nigeria, Pakistan, Peru, Philippines, Poland, Romania, Russian Federation, South Africa, Spain, Sudan, Sweden, Turkey, Ukraine, United Kingdom of Great Britain and Northern Ireland, United States of America, Uruguay, Venezuela and Viet Nam.

3. Representatives of the following specialized agencies and other organizations in the United Nations system attended the session: United Nations Educational, Scientific and Cultural Organization (UNESCO), International Telecommunication Union (ITU), World Meteorological Organization (WMO) and International Atomic Energy Agency (IAEA).

4. Representatives of the European Space Agency (ESA), Committee on Space Research (COSPAR), International Academy of Astronautics (IAA), International Astronautical Federation (IAF), International Astronomical Union (IAU), International Society for Photogrammetry and Remote Sensing (ISPRS) and International Space University (ISU) also attended the session.

5. A list of the representatives of Member States, specialized agencies and other international organizations attending the session is contained in document A/AC.105/C.1/INF.27.

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6. On 9 February 1998, the Subcommittee adopted the following agenda:

1. Election of the Chairman.

2. Adoption of the agenda.

3. Statement by the Chairman.

4. General exchange of views.

5. United Nations Programme on Space Applications and the coordination of space activities within the United Nations system.

6. Preparations for the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) by the Advisory Committee for UNISPACE III.

7. Matters relating to remote sensing of the Earth by satellites, including, *inter alia*, applications for developing countries.

8. Use of nuclear power sources in outer space.

9. Space debris.

10. Questions relating to space transportation systems and their implications for future activities in space.

11. Examination of the physical nature and technical attributes of the geostationary orbit and of its utilization and applications, including, *inter alia*, in the field of space communications, as well as other questions relating to space communications developments, taking particular account of the needs and interests of developing countries.

12. Matters relating to life sciences, including space medicine.

13. Progress in national and international space activities related to the Earth environment, in particular progress in the International Geosphere-Biosphere (Global Change) Programme.

14. Matters relating to planetary exploration.

15. Matters relating to astronomy.

16. The theme fixed for special attention at the thirty-fifth session of the Scientific and Technical Subcommittee: "Scientific and technical aspects and applications of space-based meteorology".

17. Other matters:

(a) Implementation of the recommendations of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space;

(b) Schedule of work for the Scientific and Technical Subcommittee at its thirty-sixth session, in 1999;

(c) Other reports.

18. Report to the Committee on the Peaceful Uses of Outer Space.

A. Election of the Chairman

7. At its 499th meeting, the Subcommittee recalled that the Committee on the Peaceful Uses of Outer Space, at its fortieth session, in 1997, adopted new measures concerning the composition of the bureaux of the Committee and its subsidiary bodies, agenda structures and duration of sessions, which are contained in annex I of its report on that session.[1] At that time, the Committee agreed that, for the first three-year term, the Chairman of the Scientific and Technical Subcommittee should be Dietrich Rex (Germany).[2]

8. At its 499th meeting, the Scientific and Technical Subcommittee elected Dietrich Rex as its Chairman for the first three-year term on the basis of the new work measures adopted by the Committee.

B. Meetings and documentation

9. The Subcommittee held 16 meetings.

10. A list of the documents that were before the Subcommittee is provided in annex I of the present report.

11. Following the adoption of the agenda, the Chairman made a statement outlining the work of the Subcommittee at its current session. He also reviewed the activities of Member States in space exploration, including important advances that had been achieved as a result of international cooperation during the past year.

12. At the 499th, 501st and 502nd meetings, the Chairman informed the Subcommittee that requests had been received from the permanent representatives of Azerbaijan, Bolivia, Costa Rica, Cuba, Paraguay, Republic of Korea, Slovakia, Thailand and Tunisia, together with the permanent observer for the League of Arab States, to attend the session. Following past practice, those delegations were invited to attend the current session of the Subcommittee and to address it as appropriate, without prejudice to further requests of that nature; that action did not involve any decision of the Subcommittee concerning status, but was a courtesy that the Subcommittee extended to those delegations.

13. General statements were made by the following delegations: Argentina, Austria, Brazil, Canada, Chile, China, Czech Republic, Ecuador, France, Germany, Greece, Hungary, India, Indonesia, Iran (Islamic Republic of), Italy, Japan, Morocco, Nigeria, Pakistan, Republic of Korea, Romania, Russian Federation, Spain, Turkey, United Kingdom, United States and Venezuela. General statements were also made by the representative of Chile, on behalf of the group of Latin American and Caribbean States, and by representatives of IAF, IAU, ISPRS and ISU.

14. At the 499th meeting, the Director of the Office for Outer Space Affairs made a statement reviewing the work programme of the Office. At the 501st meeting, the Expert on Space Applications made a statement outlining the activities carried out and planned under the United Nations Programme on Space Applications.

C. Technical presentations

15. In accordance with General Assembly resolution 52/56, paragraph 15 (b), a symposium on the theme "Scientific and technical aspects and applications of space-based meteorology" was organized by COSPAR and IAF to complement discussions within the Subcommittee on the special theme. The first session of the symposium, entitled "Technical aspects of space-based meteorology", was held on 9 February 1998 and was co-chaired by K. Doetsch, representing IAF, and G. Haerendel, representing COSPAR. The second session of the symposium, entitled "Scientific aspects and operational applications of space-based meteorology", was held on 10 February 1998 and was co-chaired by J. Ortner, representing IAF, and J. L. Fellous, representing COSPAR.

16. The presentations to the symposium included the following: "The World Weather Watch Programmes, present and future aspects", by R. C. Landis of WMO; "The METEOSAT second generation and Metop programmes", by A. Ratier of the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT); "GOES and NOAA spacecraft", by L. Enomoto of the National Oceanic and Atmospheric Administration (NOAA) of the United States; "Chinese meteorological satellites", by Huang Hanwen of the China National Space Administration; "Applications of satellite meteorology to monitoring and predicting the east Asia monsoon", by H. Chung of the Republic of Korea; "Climate variability: the 1997/98 El Niño", by H. Grassl of the World Climate Research Programme; "Scientific aspects and applications of the Tropical Rainfall Measuring Mission and its follow-on mission", by E. Im of the National Aeronautics and Space Administration (NASA) Jet Propulsion Laboratory of the United States; "Disaster management using Indian remote sensing satellites", by G. M. Nair of the Indian Space Research Organization (ISRO); "Meteorological systems for desert monitoring", by M. Kabbaj of the Royal Centre for Spaceborne Remote Sensing (CRTS) of Morocco; and "Land cover studies using meteorological satellites", by N. J. Ferreira of the National Institute for Space Research (INPE) of Brazil.

17. In response to General Assembly resolution 52/56, F. Alby (France), A. Kato (Japan), S. Koulik (Russian Federation), M. Yakovlev (Russian Federation), R. Crowther (United Kingdom), J. Loftus (United States), W. Flury of ESA, J. Contant of IAA and N. Johnson of the Inter-Agency Space Debris Coordination Committee (IADC) made technical presentations on the complex issue of space debris and the solutions currently being adopted at the national and international levels.

18. During the course of the session, scientific and technical presentations were made by L. Beckel (Austria) on Austrian efforts in global monitoring; by R. Hernández (Chile) on remote sensing; by Q. Tong (China) on development and applications of the meteorological satellites in China; by M. Vauzelle (France) on training and pedagogic transfers; by N. Verdier (France) on programmes for young people; by K. R. Sridhara Murthy (India) on the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III); by A. Mason (Italy) on the Satellite Health Access for Remote Environment Demonstrator (SHARED) project in telemedicine; by A. Layachi (Morocco) on training and education in space technology; by M. Ait (Morocco) and N. Gargir (France) on remote sensing and GIS applications for rangeland inventory and monitoring in Morocco (GEOSTAT project); by A. Krasnov (Russian Federation) on the International Space Station: perspectives of cooperation; by V. V. Shalyguin (Russian Federation) on the use of imagery from Russian defence satellites for the purpose of international cooperation; by R. Wilcox (United States) on the Cassini mission; and by C. Wooldridge (United States) on Landsat 7.

D. Recommendations of the Scientific and Technical Subcommittee

19. After considering the various items before it, the Subcommittee, at its 514th meeting, on 20 February 1998, adopted its report to the Committee on the Peaceful Uses of Outer Space, containing its views and recommendations as set out in the paragraphs below.

I. UNITED NATIONS PROGRAMME ON SPACE APPLICATIONS AND THE COORDINATION OF SPACE ACTIVITIES WITHIN THE UNITED NATIONS SYSTEM

20. In accordance with General Assembly resolution 52/56, paragraph 15 (a), the Subcommittee continued its consideration of the item on a priority basis.

A. United Nations Programme on Space Applications

21. The Subcommittee had before it the report of the United Nations Expert on Space Applications (A/AC.105/693 and Corr.1 and Add.1). The report was supplemented by a statement from the Expert. The Subcommittee noted that the United Nations Programme on Space Applications for 1997 had been carried out satisfactorily and commended the work accomplished by the Expert in that regard.

22. The Subcommittee noted with appreciation that, since its previous session, additional contributions had been offered by various Member States and organizations and that they had been acknowledged in the report of the Expert (A/AC.105/693 and Corr.1 and Add.1, paras. 33-34).

23. The Subcommittee continued to express its concern over the still limited financial resources available for carrying out the United Nations Programme on Space Applications and appealed to Member States to support the Programme through voluntary contributions. The Subcommittee felt that the limited resources of the United Nations should be focused on the activities with the highest priority and noted that the United Nations Programme on Space Applications was the priority activity of the Office for Outer Space Affairs.

1. 1997-1998

United Nations conferences, training courses, workshops and symposia

24. With regard to the activities of the Programme carried out in 1997 and early in 1998, the Subcommittee expressed its appreciation to the following:

(a) The Government of Sweden, represented by the Swedish International Development Agency, for co-sponsoring the Seventh United Nations International Training Course on Remote Sensing Education for Educators, hosted by the Department of Physical Geography of Stockholm University and the Swedish Space Corporation and held at Stockholm and Kiruna, Sweden, from 5 May to 13 June 1997;

(b) The Government of Namibia, as well as ESA, for co-sponsoring the Cooperative Information Network Linking Scientists, Educators, Professionals and Decision Makers in Africa (COPINE) Workshop, hosted by the University of Namibia and held at Windhoek from 19 to 23 May 1997;

(c) The Government of Honduras, as well as ESA and the Planetary Society, for co-sponsoring the Seventh United Nations/European Space Agency Workshop on Basic Space Science: Small Astronomical

Telescopes and Satellites in Education and Research, hosted by the Observatorio Astronómico de la Universidad Nacional Autónoma de Honduras and held at Tegucigalpa from 16 to 20 June 1997;

(d) The Government of Austria, as well as the province of Styria, the city of Graz and ESA, for co-sponsoring the United Nations/Austria/European Space Agency Symposium on Space Industry Cooperation with Developing Countries, held at Graz, Austria, from 8 to 11 September 1997;

(e) The Government of Israel for co-sponsoring the United Nations Workshop on Space Communications for Capacity Building, hosted by the S. Neaman Institute and held at Haifa, Israel, from 21 to 25 September 1997;

(f) The Government of Italy, IAF, the European Commission and ESA for co-sponsoring the United Nations/International Astronautical Federation Workshop on Space Technology as a Cost-Effective Tool to Improve Infrastructures in Developing Countries, hosted by the Italian Space Agency and held at Turin, Italy, from 2 to 5 October 1997;

(g) The Government of Brazil, as well as ESA and COSPAR, for co-sponsoring the United Nations/European Space Agency/Committee on Space Research Workshop on Data Analysis Techniques, hosted by INPE and held at São José dos Campos, Brazil, from 10 to 14 November 1997;

(h) ESA for co-sponsoring the United Nations/European Space Agency Training Course for Experts from English-Speaking African Countries on Applications of the European Remote Sensing Satellite Data to Natural Resources, Renewable Sources of Energy and the Environment, hosted by ESA/European Space Research Institute (ESRIN) and held at Frascati, Italy, from 24 November to 5 December 1997;

(i) The Government of Austria for co-sponsoring the United Nations Seminar on the Age of Space Commercialization: Evolving Role of Governments and Industries in Enhancing International Cooperation in Space Activities, hosted by the Austrian Federal Ministry of Foreign Affairs and the province of Tyrol and held at Alpbach, Austria, from 29 January to 1 February 1998.

25. The Subcommittee took note of the status of United Nations workshops, training courses, symposia and conferences planned for 1998, including the following, which were described in the report of the Expert on Space Applications (A/AC.105/693 and Corr.1 and Add.1, annex VI):

(a) United Nations/Centre for Space Science and Technology Education in Asia and the Pacific Workshop on Emerging Trends in Satellite Meteorology: Technology and Applications, to be held at Ahmedabad, India, from 9 to 12 March 1998;

(b) Second United Nations International Conference on Spin-off Benefits of Space Technology, to be held at Tampa, Florida, United States, from 30 March to 3 April 1998;

(c) United Nations Asian and Pacific regional preparatory meeting for UNISPACE III, to be held at Kuala Lumpur from 18 to 22 May 1998;

(d) Eighth United Nations International Training Course on Remote Sensing Education for Educators, to be held at Stockholm and Kiruna, Sweden, from 4 May to 12 June 1998;

(e) United Nations/European Space Agency Symposium on Economic Benefits of Applying Space Systems for Resource Planning, Education and Communication Infrastructure, being organized with the

Government of Austria, the province of Styria, the city of Graz and ESA, to be held at Graz, Austria, from 7 to 10 September 1998;

(f) United Nations/Space System for Tracking Ships in Distress/Search and Rescue Satellite-Aided Tracking System Workshop on Space Technology for Emergency Aid, to be held at Maspalomas, Canary Islands, Spain, from 16 to 18 September 1998;

(g) United Nations African regional preparatory meeting for UNISPACE III, to be held at Tunis from 21 to 25 September 1998;

(h) United Nations/International Astronautical Federation Workshop on Expanding the User Community of Space Technology in Developing Countries, being co-sponsored by ESA and the European Commission and organized in cooperation with the Government of Australia, to be held at Melbourne, Australia, from 24 to 27 September 1998;

(i) Workshop on the Evaluation of the United Nations International Training Course Series in Sweden on Remote Sensing Education for Educators, to be held at Gaborone in September or October 1998;

(j) United Nations Latin American and Caribbean regional preparatory meeting for UNISPACE III, to be held at Santiago, Chile, in October 1998;

(k) United Nations/ESA training course in Africa on COPINE, to be held in Africa in the third quarter of 1998.

Long-term fellowships for in-depth training

26. The Subcommittee expressed appreciation to ESA for having offered five training fellowships in various areas relating to space activities for the period 1997-1998. The status of the fellowships for the period 1997-1998 and the countries whose candidates had received fellowships were indicated in the report of the Expert (A/AC.105/693 and Corr.1 and Add.1, annex II).

27. The Subcommittee noted with satisfaction that China had offered to the United Nations Programme on Space Applications two long-term fellowships for the period 1998-1999.

28. The Subcommittee noted that it was important to increase the opportunities for in-depth education in all areas of space science, technology and applications projects through long-term fellowships and urged Member States to make such opportunities available at their relevant institutions.

Technical advisory services

29. The Subcommittee took note of the technical advisory services being provided under the United Nations Programme on Space Applications in support of projects on regional space applications, as indicated in the report of the Expert (A/AC.105/693 and Corr.1 and Add.1, paras. 17-27):

(a) Assistance to the Government of Uruguay in its follow-up, as *pro tempore* secretariat, of the recommendations of the Third Space Conference of the Americas;

(b) Assistance to the Government of the Republic of Korea in the growth and operation of the Asia-Pacific Satellite Communications Council;

(c) Collaboration with several African countries on the implementation of the COPINE project in order to address one of the recommendations of the United Nations Regional Conference on Space Technology for Sustainable Development in Africa, held at Dakar from 25 to 29 October 1993, regarding the urgent need to establish an efficient communications network among African and European professionals and scientists at the national, continental and intercontinental levels;

(d) Collaboration with ESA and the Department of Economic and Social Affairs of the Secretariat on follow-up activities related to the recommendations of the training courses on applications of the European Remote Sensing Satellite data to natural resources, renewable energy and the environment held at Frascati, Italy, in 1993, 1994, 1995 and 1997;

(e) Collaboration with ESA on follow-up activities relating to the series of workshops on basic space science;

(f) Follow-up to the United Nations international training course series in Sweden on remote sensing education for educators;

(g) Contribution to the Committee on Earth Observation Satellites (CEOS) proposal entitled "Changing face of the Earth: an Earth observation treatise".

Promotion of greater cooperation in space science and technology

30. The Subcommittee noted that the United Nations was collaborating with international professional bodies within the space community to promote the exchange of experiences on space activities. The United Nations Programme on Space Applications had co-sponsored the United Nations/International Astronautical Federation Workshop on Space Technology as a Cost-Effective Tool to Improve Infrastructures in Developing Countries, held at Turin, Italy, in October 1997 in conjunction with the forty-eighth Congress of the International Astronautical Federation. Participants at the Workshop also attended the Congress.

31. The Subcommittee noted that in 1998 the United Nations Programme on Space Applications would co-sponsor the participation of scientists from developing countries in the United Nations/International Astronautical Federation Workshop on Expanding the User Community of Space Technology in Developing Countries, which would be held at Melbourne, Australia, from 24 to 27 September 1998, in conjunction with the forty-ninth Congress of the International Astronautical Federation, and that participants at the Workshop would also attend the Congress, which would be held from 28 September to 2 October 1998. The Subcommittee also noted that the Programme would also sponsor the participation of scientists from developing countries in the thirty-second Scientific Assembly of the Committee on Space Research scheduled to be held at Nagoya, Japan, from 12 to 19 July 1998.

2. 1999

United Nations conferences, training courses, workshops and symposia

32. The Subcommittee recommended the approval of the following programme of conferences, training courses, workshops and symposia proposed for 1999, which to the extent possible should disseminate information on UNISPACE III:

(a) Ninth United Nations International Training Course on Remote Sensing Education for Educators, to be held at Stockholm;

(b) Third United Nations International Conference on Spin-off Benefits of Space Technology: Challenges and Opportunities;

(c) United Nations/European Space Agency Workshop on Basic Space Science: World Space Observatory;

(d) United Nations/Austria symposium on the use of space technology for development, to be held at Graz, Austria;

(e) United Nations/International Astronautical Federation Workshop on Information in Support of Sustainable Management, to be held in the Netherlands;

(f) United Nations Third Seminar on Space Futures and Human Security, to be held in the province of Tyrol, Austria;

(g) United Nations/China workshop on applications of space technology in sustainable agricultural development;

(h) United Nations regional preparatory meeting for UNISPACE III, to be held in Romania.

B. International space information service

33. The Subcommittee noted with satisfaction that the Office for Outer Space Affairs had continued to develop a World Wide Web home page (http://www.un.or.at/OOSA/index.html), including both information within the United Nations system and access to external databases.

34. The Subcommittee noted with satisfaction the publication of the document entitled *Seminars of the United Nations Programme on Space Applications: Selected Papers on Space Science Education, Remote Sensing and Small Satellites* (A/AC.105/690).

C. Reports

35. The Subcommittee took note with appreciation of the reports submitted to it by Member States and international organizations in response to the recommendations of the Working Group of the Whole in its report on the work of its eleventh session. It also noted with satisfaction that the Secretariat had prepared a study on applications of space communications technology to distance education (A/AC.105/667).

D. Coordination of space activities within the United Nations system and inter-agency cooperation

36. The Subcommittee noted that the General Assembly, in its resolution 52/56, paragraph 20, had invited all Governments within the organizations of the United Nations system and other intergovernmental organizations working in the field of outer space or on space-related matters to take effective action for the implementation of the recommendations of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE 82).

37. The Subcommittee continued to stress the necessity of ensuring continuous and effective consultations and coordination in the field of outer space activities among organizations within the United Nations system and the avoidance of duplicative activities. The Subcommittee noted that the sessions of the Inter-Agency Meeting on Outer Space Activities would be convened at the United Nations Office at Vienna and would be hosted by

the Office for Outer Space Affairs prior to the sessions of the Committee each year, without prejudice to any invitation by an interested agency to host a session at its headquarters. The Subcommittee noted with satisfaction that the Inter-Agency Meeting on Outer Space Activities had been held at the United Nations Office at Vienna from 28 to 30 May 1997 and that the report on its deliberations (A/AC.105/676) and the report entitled "Coordination of outer space activities within the United Nations system: programme of work for 1997 and 1998 and future years" (A/AC.105/675) were before the Subcommittee.

38. The Subcommittee noted that the next session of the Inter-Agency Meeting on Outer Space Activities was scheduled to be held at the United Nations Office at Vienna from 2 to 3 June 1998.

E. Regional and interregional cooperation

39. The Subcommittee noted with appreciation the continuing efforts undertaken by the United Nations Programme on Space Applications, in accordance with General Assembly resolution 45/72, in leading an international effort to establish regional centres for space science and technology education in existing national or regional educational institutions in developing countries. The Subcommittee also noted that, once established, each centre could expand and become part of a network that could cover specific programme elements in established institutions related to space science and technology in each region.

40. The Subcommittee recalled that the General Assembly, in its resolution 50/27, had endorsed the recommendation of the Committee that the centres be established on the basis of affiliation to the United Nations as early as possible and that such affiliation would provide the centres with the necessary recognition and would strengthen the possibilities of attracting donors and of establishing academic relationships with national and international space-related institutions.

41. The Subcommittee recalled that the General Assembly, in its resolution 52/56, had noted with satisfaction that, in accordance with paragraph 30 of its resolution 50/27, the Centre for Space Science and Technology Education in Asia and the Pacific had continued its education programme in 1997 and that significant progress had been achieved in establishing regional centres for space science and technology education in the other regions.

42. The Subcommittee noted with satisfaction that the Centre for Space Science and Technology Education in Asia and the Pacific would begin its fourth nine-month course on 1 March 1998 at the Space Applications Centre at Ahmedabad, India. The theme of the course for the current year would be satellite meteorology and global climate; the course would be launched with a four-day workshop on the subject co-sponsored by the United Nations.

43. The Subcommittee recommended that the Member States concerned in Asia and the Pacific undertake further consultations, with the assistance of the Office for Outer Space Affairs, with a view to making the Centre grow into a network of nodes.

44. The Subcommittee noted with satisfaction that Brazil and Mexico had signed the agreement to establish the Centre for Space Science and Technology Education in Latin America and the Caribbean in March 1997 and that the agreement had been ratified by the Mexican Senate in April 1997 and by the Brazilian Parliament in December 1997. The Subcommittee also noted with satisfaction the statement of the representative of Chile, on behalf of the group of Latin American and Caribbean States, supporting the future establishment and operation of the Centre for the benefit of the States in the region and expressing the profound interest of those States in participating in the activities of the Centre. The Subcommittee noted that it had been presented with a list of training activities offered in 1998 within the framework of the recently created regional Centre.

45. Regarding the centres in Africa, the Subcommittee noted that Morocco (for the French-speaking African States) and Nigeria (for the English-speaking African States) had developed and circulated for comment, agreements that would be entered into by the States concerned. The Subcommittee noted with satisfaction that the Centre for Space Science and Technology Education for French-speaking African Countries would be inaugurated in Morocco from 23 to 24 April 1998 with the agreement of the Office for Outer Space Affairs.

46. The Subcommittee noted that discussions were in progress between the Office for Outer Space Affairs and Jordan, Saudi Arabia and the Syrian Arab Republic on the establishment of a regional centre in western Asia.

47. The Subcommittee noted that discussions between Bulgaria, Greece, Poland, Romania, Slovakia and Turkey were in progress on the establishment of a network of space science and technology education and research institutions for central eastern and south-eastern European countries and that the activities of the network would be in harmony with the relevant work of existing institutions in Europe and would be open to international cooperation. The Subcommittee also noted that, during its current session, the representatives of Bulgaria, Greece, Poland, Romania, Slovakia and Turkey had stated that they had agreed to establish the network. The Subcommittee further noted that informal consultations had taken place to discuss the undertaking of an evaluation mission to study the technical requirements, design, operation, mechanism and funding of the network. The Subcommittee noted with satisfaction that Members of the network welcomed the decision of Hungary to join the network.

48. The Subcommittee noted that the satellite-based COPINE project would offer an excellent opportunity for the exchange of information needed to promote progress in health care, agriculture, education, science and technology, and the management and survey of natural resources and the environment in Africa. The Subcommittee noted that such cooperation would provide long-term benefits to the participating African countries and would contribute to economic growth in the region. The Subcommittee also noted that the technical soundness and viability of the project had been established as reflected in the resolution adopted by the COPINE Provisional Governing Board at its meeting held at Helsinki on 8 July 1997 (A/AC.105/693 and Corr.1 and Add.1, annex III).

49. The Subcommittee noted the contributions made by specialized agencies and other international organizations towards the promotion of international cooperation in space activities: WMO was continuing international cooperative programmes using space technology for monitoring global climate and detecting its changes, including the World Weather Watch and the Tropical Cyclone Programme; the International Telecommunication Satellite Organization (INTELSAT) was further developing its system for international satellite communications and broadcasting, including its programmes for training and technical assistance; and ESA was continuing its programme of international cooperative space activities, including training programmes for the benefit of developing countries, support of the activities of the United Nations Programme on Space Applications and technical assistance projects.

50. The Subcommittee noted with satisfaction that the regional preparatory meetings for UNISPACE III, mentioned in paragraph 25 above, would serve to promote regional and interregional cooperation.

51. The Subcommittee emphasized the importance of regional and international cooperation in making the benefits of space technology available to all countries by such cooperative activities as sharing payloads, disseminating information on spin-off benefits, ensuring compatibility of space systems and providing access to launch capabilities at reasonable cost.

II. PREPARATIONS FOR THE THIRD UNITED NATIONS CONFERENCE ON THE EXPLORATION AND PEACEFUL USES OF OUTER SPACE (UNISPACE III)

52. The Advisory Committee noted that the General Assembly, in its resolution 52/56, paragraph 23, had agreed that the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) should be convened at the United Nations Office at Vienna from 19 to 30 July 1999 as a special session of the Committee on the Peaceful Uses of Outer Space, open to all States Members of the United Nations.

53. The Advisory Committee also noted that the General Assembly, in paragraph 24 of the same resolution, had endorsed the recommendations of the Preparatory Committee at its 1997 session, contained in paragraphs 150-161 of the report of the Committee on the Peaceful Uses of Outer Space on its fortieth session,[3] and had requested the Preparatory and Advisory Committees and the executive secretariat to carry out their tasks in accordance with those recommendations and to report to the Assembly at its fifty-third session.

54. The Advisory Committee further noted that the General Assembly, in paragraph 17 of the same resolution, had agreed that the Working Group of the Whole should be reconvened to assist the Advisory Committee in its preparatory work for UNISPACE III. Accordingly, the Advisory Committee requested the Working Group of the Whole to give full consideration to the tasks entrusted to the Advisory Committee by the Assembly and to report thereon to the Advisory Committee.

55. At its 513th meeting, on 19 February 1998, the Advisory Committee adopted the report of the Working Group of the Whole, contained in paragraphs 13-43 of annex II to the present report, and noted that the report of the Working Group provided the basis for the Preparatory Committee to carry out the task entrusted to it by the General Assembly.

56. The Subcommittee recommended that, in accordance with General Assembly resolution 52/56, the Working Group of the Whole should be reconvened in 1999 in order to continue to assist the Advisory Committee in its preparatory work for UNISPACE III.

III. MATTERS RELATING TO REMOTE SENSING OF THE EARTH BY SATELLITES INCLUDING, *INTER ALIA*, APPLICATIONS FOR DEVELOPING COUNTRIES

57. In accordance with General Assembly resolution 52/56, paragraph 15 (a), the Subcommittee continued its consideration, on a priority basis, of the item relating to remote sensing of Earth.

58. In the course of the debate, delegations reviewed national and cooperative programmes in remote sensing. Examples were given of national programmes in developing and developed countries and of international programmes based on bilateral, regional and international cooperation, including programmes of technical cooperation between developing countries. Delegations of countries with advanced capabilities, including some developing countries, described programmes to provide assistance to developing countries.

59. The Subcommittee took note of the continuing programmes of Argentina, Australia, Austria, Brazil, Canada, China, Ecuador, France, Hungary, Germany, India, Indonesia, Iraq, Japan, Lebanon, Morocco, Romania, Russian Federation, Ukraine and United States, as well as ESA, for the development and use of information generated from remote sensing satellites. The Subcommittee noted that the European remote sensing satellite (ERS-2), the RADARSAT satellite of Canada, the Tropical Rainfall Measuring Mission (TRMM) of Japan and the United States and the IRS-P3 satellite of India were providing valuable microwave

data to complement the data already accumulated from ERS-1 and from the Japanese Earth Resources Satellite-1 (JERS-1) and the visible and infra-red data from IRS-1C and the recently launched IRS-1D, as well as the Fengyan 1 and 2, Landsat, Resurs, French Système pour l'observation de la Terre (SPOT), Indian Remote Sensing (IRS) and Marine Observation Satellite (MOS) series of satellites.

60. The Subcommittee also noted the remote sensing systems being developed for future launch, including SAC-C of Argentina, the Second Data Collecting Satellite (SCD2) of Brazil, RADARSAT-II of Canada, CBERS of Brazil and China, Jason-1 of France and the United States, ADEOS II and the Advanced Land Observing Satellite (ALOS) of Japan, new satellites planned for the IRS series of India and the Envisat satellite of ESA. The Subcommittee also noted that the Russian Federation had continued operation of the Meteor-3, Resurs-01 and GOMS Electro series of remote sensing satellites and also of the research module Priroda docked with the orbital space station Mir, within the framework of Russian national and international programmes. It took note of the joint German-Russian long-term Modular Optoelectronic Multispectral Stereo-Scanner (MOMS/Priroda) mission on the space station Mir, the RADARSAT Applications Development Research Opportunity (ADRO) programme of NASA and the Canadian Space Agency, and the activities of France in the area of combating desertification using SPOT data in cooperation with the countries concerned. It also took note of the activities of ISPRS in promoting international cooperation in remote sensing and image processing. The Subcommittee heard scientific and technical presentations on global monitoring, the GEOSTAT project of Morocco, the use of imagery from Russian defence satellites for the purpose of international cooperation, and Landsat 7 of the United States, as described in paragraph 18 of the present report.

61. The Subcommittee reiterated its view that remote sensing activities should take into account the need to provide appropriate and non-discriminatory assistance to meet the needs of developing countries.

62. The Subcommittee emphasized the importance of making remote sensing data and analysed information openly available to all countries at reasonable cost and in a timely manner. The Subcommittee also recognized the example of international cooperation in WMO in the exchange of meteorological data as provided for in resolution 11.4/1 adopted at the XIIth WMO Congress on 21 June 1995. Some delegations called attention to international cooperation given by some members through traditionally free and open provision of meteorological satellite data and encouraged those countries to continue that practice.

63. The Subcommittee considered that international cooperation in the use of remote sensing satellites should be encouraged, through both the coordination of ground station operations and regular meetings between satellite operators and users. It noted the importance of compatibility and complementarity of existing and future remote sensing systems, as well as the need for continuity in the acquisition of data. The Subcommittee also noted the importance, particularly for developing countries, of sharing experiences and technologies, of cooperation through international and regional remote sensing centres and of working on collaborative projects. The Subcommittee further noted the value of remote sensing systems for environmental monitoring and, in that context, stressed the need for the international community to fully utilize remote sensing data in an effort to fully implement the recommendations contained in Agenda 21,[4] adopted by the United Nations Conference on Environment and Development, held at Rio de Janeiro from 3 to 14 June 1992.

64. The Subcommittee noted with satisfaction the prototype CEOS Information Locator Service (CILS), funded by the German Space Agency (DARA) and currently in the demonstration phase. The Subcommittee also noted that the system was being designed to assist users in developing countries in locating and accessing sources of information about Earth observation data, projects and services to meet their needs. It further noted that the system technology was based on a special World Wide Web server that would be installed at various strategic nodes and would be equipped with a feature to enable users in developing countries to include and maintain their own data and to design the content to suit their own specific needs.

65. The Subcommittee took note of the programmes of Argentina, Bulgaria, China, Mexico, Morocco, Pakistan, Romania and Spain in the area of small satellites and microsatellites. The Subcommittee recalled that at its thirty-third session, it had recommended that more of the activities of the United Nations Programme on Space Applications should be devoted to that theme (A/AC.105/637 and Corr.1, para. 182). The Subcommittee noted the ongoing multilateral cooperation in the area of small multi-mission satellite development with the participation of China, Pakistan, the Republic of Korea, Thailand and other countries in the region.

66. The Subcommittee recommended that further consideration of the item be postponed until the year 2000 in view of its abbreviated schedule of work at its thirty-sixth session, in 1999, and the preparatory work to be carried out for UNISPACE III.

IV. USE OF NUCLEAR POWER SOURCES IN OUTER SPACE

67. In accordance with General Assembly resolution 52/56, paragraph 15 (a), the Subcommittee continued its consideration, on a priority basis, of the item on the use of nuclear power sources in outer space.

68. The Subcommittee recalled that the General Assembly had adopted the Principles Relevant to the Use of Nuclear Power Sources in Outer Space, contained in resolution 47/68. The Subcommittee noted that the Committee, at its fortieth session, had recalled its agreement that the Principles should remain in their current form until amended and that, before amendment, proper consideration should be given to the aims and objectives of any proposed revision.[5] The Committee had agreed with the Subcommittee (A/AC.105/672, para. 80) that, while a revision of the Principles was not necessary at the current stage, it was important that States making use of nuclear power sources should conduct their activities in full accordance with the Principles.[6]

69. The Subcommittee agreed that, at the present time, revision of the Principles was not warranted. It also agreed that, until a firm scientific and technical consensus had been reached on the revision of the Principles, it would be inappropriate to pass on the topic to the Legal Subcommittee.

70. The Scientific and Technical Subcommittee also recalled that it had agreed at previous sessions that regular discussions on the agenda item should continue at future sessions and that it should continue to receive the widest input on matters affecting the use of nuclear power sources in outer space and any contribution related to improving the scope and application of the Principles.

71. The Subcommittee noted the statement made by the representative of IAEA stating that the Principles should be reviewed in view of the most recent International Commission on Radiological Protection (ICRP) recommendations on radiation safety incorporated into the IAEA International Basic Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, published by IAEA as Safety Series No. 115. The representative of IAEA had noted in particular that the Principles relating to notification of re-entry of space objects with nuclear power sources on board, as well as those relating to subsequent assistance to States, should be revised in view of the Convention on Early Notification of a Nuclear Accident[7] and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency.[8]

72. Mindful of the differences in the safety principles applied for space and the safety standards for terrestrial systems, the Subcommittee agreed that the study of those developments, arising from the latest ICRP recommendations, should be continued.

73. The Subcommittee took note of the working papers submitted by the Russian Federation on collisions of nuclear power sources with space debris (A/AC.105/C.1/L.220) and on the use of nuclear power sources in outer

space (A/AC.105/C.1/L.223). The Subcommittee also took note of a working paper submitted jointly by the Russian Federation, the United Kingdom and the United States on a work plan for developing a framework for safety assurance processes and standards for nuclear power sources in outer space (A/AC.105/C.1/L.222).

74. The Subcommittee, at its 509th meeting, on 17 February 1998, agreed to reconvene its Working Group on the Use of Nuclear Power Sources in Outer Space, under the chairmanship of Dietrich Rex (Germany). The Working Group held three meetings between 17 and 19 February 1998. At the meeting held on 19 February 1998, the Working Group adopted its report.

75. At its 513th meeting, on 19 February 1998, the Subcommittee endorsed the report of the Working Group, including its recommendations. The report of the Working Group is contained in annex III to the present report.

76. The Subcommittee noted that in response to its recommendation, the General Assembly, in resolution 52/56, paragraph 18, had invited Member States to report to the Secretary-General on a regular basis with regard to national and international research concerning the safety of space objects with nuclear power sources on board. The Subcommittee also noted that the Assembly, in paragraph 29 of the same resolution, had considered that, to the extent possible, information on the problem of collisions of space objects, including those with nuclear power sources, with space debris should be provided to the Subcommittee. The Subcommittee noted that Canada, Chile, France, Germany, Indonesia, Japan, Sweden and United Kingdom, together with the International Law Organization and INTELSAT, had submitted information (A/AC.105/680 and Add.1) in response to those requests.

77. The Subcommittee agreed that Member States should continue to be invited to report to the Secretary-General on a regular basis with regard to national and international research concerning the safety of space objects with nuclear power sources. The Subcommittee also agreed that further studies should be conducted on the issue of the collision of space objects with nuclear power sources on board with space debris and that it should be kept informed of the results of such studies.

78. Some delegations expressed the view that space objects with nuclear power sources on board could be used for limited purposes such as interplanetary space missions where conventional solar power might not provide sufficient power. The view was expressed that, since most accidents occurred in the ascending, descending and pre-orbital stages, it was important to follow the Principles and to continue in-depth studies on operational technology and safety norms. That delegation also expressed the view that the launch vehicles used for space objects with nuclear power sources on board should be designed to ensure successful launches and to avoid the destruction of the nuclear power source in the event of an accident through the reinforced structure and the design of the nuclear power source on board.

79. The view was expressed that, in developing future space objects equipped with nuclear power sources, studies should continue to be undertaken with a view to formulating measures to ensure radiological, nuclear and ecological safety aimed at minimizing the effects of ionizing emissions and radioactive and toxic materials on the population and the environment, including outer space. That delegation also expressed the view that the safety of those spacecraft at all stages of their operation and in the event of foreseeable accidents would be ensured by safety systems and nuclear power source structural elements designed to meet safety requirements and by special comprehensive administrative and technical measures to prevent accidents and eliminate the effects of accidents.

80. The Subcommittee agreed that a suitable approach to its consideration of the agenda item was contained in the working paper submitted jointly by the Russian Federation, the United Kingdom and the United States (A/AC.105/C.1/L.222), which included a four-year work plan to develop a framework for safety assurance processes and standards for nuclear power sources in outer space.

81. The Subcommittee recommended that further consideration of the item be postponed until the year 2000 in view of its abbreviated schedule of work at its thirty-sixth session, in 1999, and the preparatory work to be carried out for UNISPACE III.

V. SPACE DEBRIS

A. General matters

82. In accordance with General Assembly resolution 52/56, the Subcommittee continued its consideration, on a priority basis, of the agenda item on space debris.

83. The Subcommittee agreed that consideration of space debris was important and that international cooperation was needed to expand appropriate and affordable strategies to minimize the potential impact of space debris on future space missions.

84. The Subcommittee noted with appreciation the report by the Secretariat (A/AC.105/681) prepared in response to its request to compile information on various steps taken by space agencies for reducing the growth or damage potential of space debris and to encourage common acceptance by the international community on a voluntary basis (A/AC.105/605, para. 80). The Subcommittee agreed that space agencies should continue to provide it with that information.

85. The Subcommittee noted that one of the most important mitigation measures was the increased awareness of the threats posed by the space debris environment and of the many sources of debris. Incorporation of debris mitigation measures early in the vehicle design phase could be cost-effective. The Subcommittee also noted that, in fact, many space missions were debris-free; and when the release of mission-related debris was unavoidable, the number of debris and their orbital lifetimes were minimized to the extent possible. It further noted that analysis of accidental fragmentations for both spacecraft and upper stages had led to the finding that vehicle passivation, i.e. the removal of all forms of stored energy, would eliminate most, if not all, such events.

86. The Subcommittee took note of the following programmes of Member States and organizations on the acquisition and understanding of data on the characteristics of the space debris environment and on measuring, modelling and mitigating the orbital debris environment. The Subcommittee noted the following modelling programmes: the fast analytical model CHAINEE and a new semi-deterministic modelling tool, the Long Term Utility for Collision Analysis (LUCA) of Germany; studies on space debris modelling in China, India, Italy and Japan; the Integrated Debris Evolution Suite (IDES) of the United Kingdom; the complex BUMPER, CHAIN, EVOLVE and ORDEM 96 models of the United States; analytical and numerical models developed by the Russian Federation and, in particular, an effective universal model developed by the Russian Space Agency Centre for Programme Studies (Nazarenko); and the Space Debris Reference Model (MASTER) of ESA. The Subcommittee also noted the following measuring and mitigation programmes: the Materi Exposure in Low Earth Orbit (MELEO) experiment and the Advanced Composite Material Exposure Experiment (ACOMEX) of Canada; the Tracking and Image Radar Station (TIRA) of Germany; the Long Duration Exposure Facility (LDEF), the Haystack Orbital Debris Radar, the Orbital Debris Radar Calibration Spheres (ODERACS-1 and 2), the Orbital Debris Collector and Polished Plate Meteoroid and Debris Experiment retrieved from the Mir space station, the Space Surveillance System, the Charged Couple Device (CCD) Debris Telescope and the Liquid Metal Mirror Telescope (LMMT) of the United States; the Space Flyer Unit (SFU), the Communication Research Laboratory (CRL) telescope system and Middle and Upper Atmosphere (MU) radar system of Japan; studies on space debris and practical mitigation techniques in China and France; and the various monitoring facilities established by the Russian Federation, including its Space Surveillance System.

87. The Subcommittee agreed that Member States should pay more attention to the problem of collisions of space objects, including those with nuclear power sources on board, with space debris and other aspects of space debris. It noted that the General Assembly, in its resolution 52/56, had called for the continuation of national research on that question, for the development of improved technology for the monitoring of space debris and for the compilation and dissemination of data on space debris. The Subcommittee recalled the request of the Assembly that information on those issues should be submitted to the Subcommittee, and it took note of the replies from Member States (A/AC.105/680 and Add.1) submitted to it in accordance with that request. The Subcommittee further agreed that national research on space debris should continue and that Member States and international organizations should make available to all interested parties the results of that research, including information on practices adopted that had proved effective in minimizing the creation of space debris.

88. The Subcommittee agreed that the words "disposal orbit" should be used in lieu of the words "graveyard orbit".

89. The Subcommittee heard scientific and technical presentations on the subject of space debris mitigation measures by representatives of France, Germany, Japan, Russian Federation, United Kingdom and United States, as well as ESA, IAA and IADC, as mentioned in paragraph 17 of the present report.

90. The Subcommittee noted that cooperation had continued through IADC, with the participation of Japan, NASA, ESA, the Russian Space Agency, the China National Space Administration, the British National Space Centre, the Centre national d'études spatiales (CNES), ISRO and, since 1997, the German Aerospace Research Establishment (DLR), to enable its members to exchange information on space debris activities, facilitate opportunities for cooperation in space debris research, review the progress of ongoing activities and identify debris mitigation options. The Subcommittee also noted that the Italian Space Agency (ASI) had applied for membership in IADC in 1997.

91. The Subcommittee noted with satisfaction that, following its invitation, representatives of IADC had made a technical presentation on the subject of space debris mitigation, as mentioned in paragraph 17 of the present report. The Subcommittee agreed that IADC should be invited to make a technical presentation on its work at the thirty-sixth session of the Subcommission.

92. The Subcommittee recalled that, in order to further its consideration of the agenda item on space debris, it had adopted at its thirty-second session a multi-year plan for the consideration of space debris. The Subcommittee also recalled that at each session it should review the current operational debris mitigation practices and consider future mitigation methods with regard to cost-efficiency (A/AC.105/637 and Corr.1, para. 92).

93. The Subcommittee noted that, at its thirty-third session, in accordance with the multi-year plan, it had focused its attention on measurements of space debris, understanding of data and effects of that environment on space systems, as reflected in its technical report for 1996 (A/AC.105/637 and Corr.1, paras. 94-138). At its thirty-fourth session, the Subcommittee had focused its attention on the modelling of the space debris environment and risk assessment, as reflected in its technical report for 1997 (A/AC.105/672, paras. 102-104).

94. The Subcommittee took note of the working papers on space debris submitted by IAA (A/AC.105/C.1/L.217) and by the Russian Federation (A/AC.105/C.1/L.219). The Subcommittee also took note of the technical changes and amendments to its technical report for 1996 and 1997 that had been proposed by IADC. The Subcommittee noted that various delegations had proposed changes to the technical report in their statements on the agenda item. The Subcommittee took note of the first two parts of the technical report, as amended at its current session (A/AC.105/C.1/L.224).

95. The Subcommittee agreed that the final technical report of the Subcommittee on space debris, which would include the part on mitigation measures drafted during its current session, should be adopted at its thirty-sixth session, in 1999, after final editing during the inter-sessional period and consideration by relevant organizations (such as IADC and IAA).

96. At its current session, the Subcommittee focused its attention on space debris mitigation measures.

B. Technical report of the Subcommittee for 1998

97. Concerned about the influence of space debris on the space environment and on the operation of spacecraft, the Subcommittee had included the item on space debris on its agenda for its thirty-first session, in 1994. It was agreed that it was important to have a firm scientific and technical basis for future action on the complex attributes of space debris.

98. The Subcommittee agreed to focus on understanding research related to space debris, including debris measurement techniques; mathematical modelling of the debris environment; characterizing the space debris environment; and measures to mitigate the risks of space debris, including spacecraft design measures to protect against space debris. Accordingly, a multi-year work plan was adopted in 1995 for specific topics to be covered during the period 1996-1998. It was also agreed that the work plan should be implemented with flexibility, so that all relevant issues on space debris could be addressed.

99. The technical report of the Subcommittee would be structured according to the specific topics addressed by the work plan during the period 1996-1998. The report would be carried forward and updated each year, leading to an accumulation of advice and guidance, in order to establish a common understanding that could serve as the basis for further deliberations of the Committee on that important matter. The report for 1998, which concentrates on space debris mitigation measures, is as follows:

3. Space debris mitigation measures

3.1 Reduction of the debris increase in time

3.1.1 Avoidance of debris generated under normal operation

3.1.1.1 Operational debris/mission objects

1. Approximately 12 per cent of the present catalogued orbital debris population consists of objects discarded during normal satellite deployment and operations. Typical objects in this category are fasteners, yaw and yo-yo weights, nozzle covers, lens caps, multiple payload mechanisms and so forth. It is normally relatively easy, both technically and economically, to take mitigation measures against these objects. Many agencies are reported to have taken such action. For example, clamp bands and sensor covers should be retained by parent bodies, and all fragments of explosive bolts should be captured. However, there may be some parts that will be released for unavoidable reasons, such as a fairing left in GTO during a dual payload mission. Every agency is encouraged to minimize these kinds of debris whenever possible using state-of-the-art equipment or techniques.

3.1.1.2 Tethers

2. Tethers may become orbital debris if they are discarded after use or if they are severed by an impacting object (man-made debris or meteoroid). Tethers several thousand metres in length and a few millimetres in diameter might not survive for extended periods. New multi-strand tether designs can reduce

the risk of being severed. At the end of missions, tethers may be retracted or the end masses may be released to accelerate the decay of the tethers.

3.1.1.3 Solid rocket motor effluents, paint and other exterior materials

3. Other mission-related particles may be generated unintentionally, as in the release of slag (up to several centimetres in diameter) during and after the burn of solid rocket motors. The precise nature of the amount and distribution of these slag ejecta are unclear, and the improvement of solid propellant and motor insulation to minimize the released solids is difficult. Attempts should be made to inhibit the generation of very small debris because of the effects of the space environment, for example, atomic oxygen erosion, solar radiation effects and the bombardment of small meteoroids. The application of more long-lasting paint and protective covering could be an effective remedial measure.

3.1.2 Prevention of on-orbit break-ups

4. The consequences of fragmentations of upper stages and spacecraft constitute approximately 42 per cent of the current identified satellite population and may account for as much as 85 per cent of all orbital debris larger than 5 cm in diameter. At least 145 space objects, with a total dry mass of more than 350,000 kg, are known to have broken up in Earth orbit. Such fragmentations are caused by either explosions or collisions.

3.1.2.1 On-orbit explosions

5. Thirty-five per cent of all fragmentation sources are upper stages or their components that operated successfully but were abandoned after the spacecraft delivery mission was completed. Such incidents have affected a wide range of launch vehicles operated by China, the Russian Federation and the United States, as well as ESA. Accidental explosions can also be caused by malfunctioning propulsion systems, overcharged batteries or explosive charges.

6. Analyses of accidental fragmentations for both spacecraft and upper stages have shown that vehicle deorbiting or passivation, i.e. the removal of all forms of stored energy, would eliminate most such events. Recommended measures include the expulsion of residual propellants by burning or venting, the discharge of electrical storage devices, the release of pressurized fluids, thermal control and safing of unused destruct devices and the unloading (despinning) of momentum wheels and similar attitude control apparatus. These measures should be performed soon after the vehicle has completed its mission, manoeuvring to a lower altitude if possible.

3.1.2.2 On-orbit collisions

7. The probability of an accidental collision in Earth orbit is currently slight, but it is becoming greater as the number and size of satellites are increasing. In 1996, the French CERISE spacecraft was struck and partially disabled by the impact of a fragment of an exploded Ariane upper stage. In addition, the possibility of other break-ups being caused by collision cannot be denied because the causes of many break-up events remain unknown. Effective measures to mitigate the consequences of break-ups caused by collision involve the spacecraft design and collision avoidance manoeuvres (see section 3.2.2 below).

3.1.3 Deorbiting and reorbiting of space objects

3.1.3.1 Mission termination of space systems

8. For space objects in low Earth orbit (LEO) reaching end of mission, each vehicle should be deorbited or placed in a reduced lifetime orbit to reduce the possibility of an accidental collision. Studies have shown that the growth of orbital debris resulting from collisions can be mitigated by limiting orbital lifetimes. This may be done with a controlled re-entry manoeuvre or by reorbiting the vehicle to a lower altitude.

9. For space objects at higher altitudes, moving vehicles into disposal orbits can also be effective in the short term. For example, the transfer of geostationary orbit (GEO) spacecraft to orbits above GEO not only protects operational spacecraft but also reduces the probability of derelict objects colliding with one another and creating debris that might threaten the GEO regime. A standardized reorbit distance value should be determined by taking into consideration factors such as perturbation effects by the gravitational force of the Sun and the Moon and solar radiation pressure. The upper stages or components of launch vehicles left in GTO may be either soon removed from orbit or, if removal is not possible, manoeuvred to prevent interference with systems in GEO. The final perigee altitude of the upper stage could be selected to ensure a limited orbital lifetime.

3.1.3.2 In case of failure

10. Space systems on orbit should be continuously monitored especially for critical malfunctions that could lead to the generation of large amounts of fragments or to loss of the ability to conduct mitigation measures. The propulsion system, batteries and the attitude and orbit control subsystem should be monitored in that context. If a malfunction occurs and the mission cannot be maintained, procedures may be implemented to prevent as much as possible interference with useful orbit, and accidental explosion.

3.2 Protection strategies

11. Given the current orbital debris population, spacecraft designers should consider incorporating implicit and explicit protection concepts into their space vehicles. A hazard for space objects and orbital stations is posed by hypervelocity impact with meteoroids and space debris particles 1-2 mm or larger. High-velocity impacts by particles as small as 1 mm in diameter can lead to loss of functions and mission failure. Even small impacts on pressure vessels may result in container ruptures. Such damage may also prevent planned passivation measures or post-mission disposal options. In many cases, the relocation of vulnerable components can greatly increase spacecraft survivability. In addition, collision avoidance can be an effective protection strategy.

3.2.1 Shielding

12. Orbital debris shields for both manned and unmanned spacecraft can be quite effective. Protection against particles 0.1-1 cm in size can be achieved by shielding spacecraft structures. Objects 1-10 cm in size cannot currently be dealt with by on-orbit shielding technology, nor can they be tracked by operational surveillance networks. However, protection against particles 1-10 cm in size can be achieved through special features in the design of space systems (redundant subsystems, frangible structures, pressure vessel isolation capabilities etc.).

13. Shielding designs may vary from simple single sheet Whipple bumpers, located in front of the spacecraft wall, to complex layers of metal and ceramic/polymer fabrics that are designed first to break up the impacting particle and then to absorb the energy of the resulting ejecta. Bumper shields should be positioned at sufficient distance from the shielded object to ensure a wide dispersion of the fragment cloud,

created as a result of the impact of the debris particles on the shield. Thus, the impact loads should be distributed over a considerable area of the protected object's body. Successful shield designs may take advantage of the structure of the vehicle and the directionality of orbital debris to protect critical components. In addition, spacecraft can be designed to place critical components in the geometric shadow of the prevailing direction of debris flux. The application of lightweight, multilayer insulation may provide protection against small debris, and the placement of sensitive equipment behind existing vehicle structures may also improve survivability.

14. The penetration depth, or damage potential, of an impacting object depends on its mass, density, velocity, and shape and on the material properties of the shield. Different modelling and simulation tools are available to predict the damage resulting from impacts on various shield designs (e.g. the NASA BUMPER model, the ESA ESABASE model, the Russian BUFFER model and several hydrocodes to perform simulations under conditions not possible using ground-based test facilities). Ground-based tests of spacecraft shields are limited, as testing for the entire range of possible impact velocities is not possible. Ground-based accelerators are currently limited to velocities of the order of 13 km/s (e.g. using shaped charge devices), but most existing data are for 7 km/s. New methods are being developed and further refined for calculating the processes involved in hypervelocity collisions between space debris particles and shields at impact velocities of 5-15 km/s.

3.2.1.1 Human space flight

15. Manned spacecraft, particularly space stations, are normally larger than most unmanned vehicles and must demonstrate higher safety standards. Protection strategies for manned missions have to incorporate both shielding measures and on-orbit repair of damage caused by penetrations. Current shield designs offer protection against objects smaller than 1 cm. The probability of no penetration (PNP) is the main criterion for shield design. PNP calculations are based on meteoroid and debris environment models and on the ballistic limit curves obtained in hydrocode simulations and hypervelocity impact experiments. The reliability of the PNP calculations is strongly linked to the accuracy of the debris and meteoroid environment model. The degree of shielding required is highly dependent upon the nature (material, thickness etc.), location and orientation of the surface to be protected. Consequently, the International Space Station will employ over 200 different types of orbital debris and micrometeoroid shields.

16. On manned spacecraft it is possible to install automatic detection systems to locate damage. In case of a puncture of a pressurized module, isolation of the module or reaction time in sealing the puncture is of primary importance. The amount of time available depends on the size of the puncture, and the time required for repair is a function of the means employed and the strategy adopted.

17. Crew members engaged in extra-vehicular activities (EVA) need protection from natural and man-made debris. Current spacesuits have many features with inherent shielding qualities to offer protecion from objects of sizes up to 0.1 mm. By properly orienting their spacecraft, astronauts may be able to use their vehicles as shields against the majority of orbital debris or direct meteroid streams.

3.2.1.2 Unmanned spacecraft

18. For unmanned spacecraft, lower PNPs are tolerable. An acceptable level of protection against small debris and meteoroid objects (smaller than 1mm) may be attained through the use of reinforced multilayer insulation materials and via design modifications, such as internal installation of fuel lines, cables and other sensitive components (for example, as implemented by RADARSAT of Canada). More robust solar array designs (i.e. collector networks) can minimize the effects of damage from collisions with small particles.

3.2.2 Collision avoidance

19. Current space surveillance systems cannot track objects in LEO with a radar cross section of less than 10 cm in equivalent diameter. In addition, it is difficult to maintain orbital parameters on small catalogue objects due to factors such as a high area-to-mass ratio and, consequently, a higher susceptibility to atmospheric density variations. For space objects large enough to be tracked by ground-based space surveillance systems (greater than 10-30 cm), collision avoidance during orbital insertion and on-orbit operations is technically possible.

20. Collision avoidance manoeuvres impact satellite operations in several ways (e.g. propellant consumption, payload data and service interruptions, and temporary reduction in tracking and orbit determination accuracy), and they should be minimized, consistent with spacecraft safety and mission objectives. Collision avoidance strategies are most effective when the uncertainty in the close approach distance is kept small, preferably less than 1 km. Collision avoidance is always probabilistic. NASA uses an acceptable risk criterion of 1 in 100,000 to consider a collision avoidance manoeuvre for STS.

3.2.2.1 On orbit

21. The United States Space Surveillance Network (SSN) and the Russian Space Surveillance System monitor the LEO environment to warn the United States Space Shuttle and the Russian Mir space station if an object is projected to come within a few kilometres. If an object is predicted to pass through a box measuring 25 km x 5 km x 5 km oriented along the flight path of the United States Space Shuttle, the SSN sensor network intensifies its tracking of the potential risk object. If the improved fly-by prediction indicates a conjunction within a box measuring 5 km x 2 km x 2 km, an avoidance manoeuvre may be performed. Since 1986, STS has executed four such evasive manoeuvres.

22. Russian specialists have compiled a catalogue of dangerous approaches to space objects (several million approaches) and an algorithm for deciding whether to proceed with an avoidance manoeuvre. It is proposed to identify hazardous situations involving the predicted approach of space debris, intensify data coverage of such events and flight control of the spacecraft requiring protection. Work is under way to establish a special telecommunication system linking Russian Space Agency (RSA) management with the Mission Control Center.

23. ESA and the Centre national d'études spatiales (CNES) of France are using two line element catalogue data and orbit determinations of their LEO spacecraft to forecast conjunction events and to initiate evasive manoeuvres if certain fly-by range limits or estimated collision risk levels are violated. For an accepted collision risk of 1 in 10,000, the ERS-1 and ERS-2 spacecraft of ESA would need to perform 1-2 manoeuvres each year. In June 1997 and July 1997, the ERS-1 satellite of ESA and the Système pour l'observation de la Terre (SPOT-2) satellite of CNES, respectively, performed collision avoidance manoeuvres.

24. As more spacecraft are launched into the GEO region, coordinated station-keeping is increasingly becoming necessary. Inclination and eccentricity vector separation strategies can be efficiently employed to keep co-located GEO spacecraft at safe distances. Eccentricity vector control may also be employed to reduce the risk of collision between members of a given LEO satellite constellation.

3.2.2.2 Launch

25. Calculations made prior to the launch of United States spacecraft permit the establishment of safe launch windows, ensuring that the spacecraft will not pass near resident manned spacecraft (i.e. STS, Mir or ISS). For the Space Shuttle, similar alert procedures are used as for the on-orbit conjunction analysis.

In the case of a predicted conjunction, the launch is delayed (to date, two Space Shuttle launches have been delayed to avoid potential collisions).

3.3 Effectiveness of debris mitigation measures

26. Probably one of the most important mitigation measures has been the increased awareness of the threats posed by the orbital debris environment and of the many sources of orbital debris. Incorporation of debris mitigation measures early in the vehicle design phase could be cost-effective. Educational efforts among the aerospace industries and national space agencies have reaped the rewards of voluntary action, guided by the principles of good stewardship of near-Earth space.

27. Since the early 1980s, the adoption of mitigation measures has had an effect on the growth of the orbital debris environment. The frequency of significant satellite fragmentations, both accidental and intentional, has dropped, curtailing the rate of growth of orbital debris. A decrease in long-lived mission-related debris is also noticeable. New debris shield technologies and designs have substantially reduced the weight of protection while increasing its effectiveness.

28. It is important to illustrate the quantitative effectiveness and relative cost of typical mitigation scenarios.

3.3.1 Scenarios of mitigation measures

29. Four typical mitigation scenarios are presented below in order to illustrate their relative effectiveness. The mitigation scenarios are not intended to be prescriptive in nature and should be used only for simulation purposes. The scenarios are the following:

(a) Reference scenario with no mitigation measures (business as usual);

(b) Minimization of mission-related objects;

(c) Passivation at end of mission;

(d) Disposal at end of mission for GEO;

(e) Deorbit at end of mission: this includes both lowering the orbit to reduce lifetime (below 25 years) and immediate re-entry.

30. It is assumed that the simulation analysis of these mitigation scenarios will start for all space activities at some point. Launch activities are assumed to take place at the rate of __ per year to include the emerging LEO constellations and other developments. There are a number of other assumptions that have been made to support the scenarios.

31. The figures are affected by relevant technical uncertainties owing to limitations to the data and models and assumptions used. These uncertainties should be taken into account in assessing the effectiveness of mitigation measures. Furthermore, the figures are not intended to imply specific implementation timelines for debris mitigation measures but rather to support a simulation analysis and illustrate the relative effectiveness of some debris mitigation measures.

32. The charts presented below indicate the total population of debris particles larger than 1 cm from now until __ for each scenario (figure I for LEO and figure II for GEO will be different).

[Chart on notional comparison to be inserted here in 1999]

3.3.2 Cost or other impact of mitigation measures

33. This section summarizes the implications of the mitigation measures in terms of their cost or some other impact of mitigation measures on aspects of mission accomplishment.

Mission lifetime reduction

Implementing disposal and deorbit measures may reduce the active mission lifetime. Since it takes fuel to accomplish these manoeuvres, it may reduce the amount of fuel that would have been available to maintain on-orbit mission operations.

Reliability of spacecraft

Implementing mitigation measures may alter the reliability of spacecraft. For example, shielding measures offer protection against small debris and radiation, which increases reliability. Some passivation measures may introduce new failure modes.

Launch performance implication

Providing for the upper stages of launchers to re-enter into the atmosphere or to have a short lifetime may influence the launch trajectory and performance.

Mass penalty

There may be some mass penalty to include devices to minimize the creation of debris and devices/fuel used to implement manoeuvres for ending mission life. For example, to deorbit an upper stage, devices such as batteries, attitude control system and fuel may need to be added.

System development cost

Modifying designs or increasing the complexity of space vehicles to implement mitigation measures may add to the system cost. This may also apply to some measures to passivate launchers and spacecraft at the end of their missions. However, designing for mitigation measures early in the process is more cost-effective than modifying a design later.

C. General views

100. Some delegations expressed the view that the elimination of the existing space debris was one of the most important mitigation measures. Even if it was not technically and economically feasible at present, the international community should not neglect the efforts to develop adequate technologies to cleanse outer space in the future.

101. The view was expressed that there was a need to develop a common database for space debris that could serve as a clearing house of information for the international community for research and further advancement of knowledge in that field.

102. Some delegations were of the view that adequate time should be allocated to the Scientific and Technical Subcommittee, at its thirty-sixth session, in 1999, for the completion of the technical report on space debris.

103. The view was expressed that the international community should consider establishing a kind of international fund for space debris to tackle the space debris issue.

104. Some delegations expressed the view that it would not be appropriate to discuss the issue of space debris in the Legal Subcommittee unless sufficient progress had been made on that issue in the Scientific and Technical Subcommittee.

105. The view was expressed that, because of the complexity of the space debris item, additional subjects might be taken up by the Scientific and Technical Subcommittee later, as appropriate, and therefore the item on space debris had to remain on the agenda of the Subcommittee after the finalization of the current working plan.

106. The Subcommittee recommended that "Space debris" be retained on its agenda as a priority item for its thirty-sixth session.

VI. QUESTIONS RELATING TO SPACE TRANSPORTATION SYSTEMS AND THEIR IMPLICATIONS FOR FUTURE ACTIVITIES IN SPACE

107. In accordance with General Assembly resolution 52/56, the Subcommittee continued its consideration of the item relating to space transportation systems.

108. In the course of the discussion, delegations reviewed national and international cooperative programmes in space transportation systems, including expendable launchers, reusable space shuttles and space stations. In particular, the Subcommittee noted that Brazil was continuing the development of the VLS launcher; that China was continuing the use and development of its Long March series of launch vehicles; that India had succeeded in the developmental launchings of the Polar Satellite Launch Vehicle and was continuing development of the Geosynchronous Satellite Launch Vehicle; that Japan was continuing the use of the H-II, J-I and M-V launch vehicles and had started to develop an upgrade of its H-II launch vehicle, namely the H-IIA launch vehicle; that the Russian Federation was continuing successful launches of space objects of various types using expendable launchers of the Soyuz, Molniya and Proton series and had sent a number of national and international crews to the Mir space station; that the Russian Federation, in cooperation with Ukraine, was planning to use in commercial space activities the Tsyklon and Zenit rocket launchers; that Spain was developing the indigenous launcher Capricornio; that the United States was continuing its programme of expendable launches and flights of the reusable Space Shuttle, many of the flights involving significant international participation, particularly during the link-ups of the Space Shuttle Atlantis with the Mir station; that Canada, Japan, the Russian Federation and the United States, together with member States of ESA, were continuing preparations for the International Space Station programme; and that ESA was successfully continuing the developmental flights of the Ariane 5 launch vehicle.

109. The Subcommittee took note of developments in the United States commercial launch industry, including the Athene, Atlas, Delta, Pegasus and Taurus expendable vehicles and the Reusable Launch Vehicle (RLV) three-pronged programme designed to demonstrate the technical feasibility of Single-Stage-to-Orbit using the X-33 sub-orbital vehicle and robust operability using the X-34 vehicle. The Subcommittee noted that the X-33 test vehicle was the most advanced part of the RLV programme, aimed at developing the kinds of technologies required by industry to build a new launch vehicle that would provide affordable and reliable access to space. The Subcommittee took note of the Hypersonic Flight Experiment (HYFLEX) and the development of the HOPE-X experimental unmanned winged vehicle of Japan.

110. The Subcommittee took note of developments in the Russian Federation, including the improved Proton-M launcher and the ecologically clean Rus and Angara launchers. The Subcommittee also took note of

the introduction into the space transportation system of the Russian Federation of the Start and Rokot launchers that were based on converted ballistic missiles. The Subcommittee noted the increasing use of the Plesetsk and Svobodny cosmodromes in the Russian Federation for commercial launchings by international enterprises, as well as plans for the modernization of the Baikonur cosmodrome in Kazakhstan and preparations for the international sea-launch enterprise.

111. The Subcommittee stressed the importance of international cooperation in space transportation in order to provide all countries with access to the benefits of space science and technology.

112. The Subcommittee recommended that further consideration of the item be postponed until the year 2000 in view of its abbreviated schedule of work at its thirty-sixth session, in 1999, and the preparatory work to be carried out for UNISPACE III.

VII. EXAMINATION OF THE PHYSICAL NATURE AND TECHNICAL ATTRIBUTES OF THE GEOSTATIONARY ORBIT; EXAMINATION OF ITS UTILIZATION AND APPLICATIONS, INCLUDING, *INTER ALIA*, IN THE FIELD OF SPACE COMMUNICATIONS, AS WELL AS OTHER QUESTIONS RELATING TO SPACE COMMUNICATIONS DEVELOPMENTS, TAKING PARTICULAR ACCOUNT OF THE NEEDS AND INTERESTS OF DEVELOPING COUNTRIES

113. In accordance with General Assembly resolution 52/56, the Subcommittee continued its consideration of the item relating to the geostationary orbit and space communications.

114. In the course of discussions, delegations reviewed national and international cooperative programmes in satellite communications, including progress in communications satellite technology that would make satellite communications more accessible and less expensive and increase the communications capacity of the geostationary orbit and the electromagnetic spectrum. The Subcommittee took note of the growing use of communications satellite systems for telecommunications, television broadcasting, data networks, environmental data relay, mobile communications, disaster warning and relief, telemedicine and other communications functions.

115. The Subcommittee noted that by gradually introducing low and medium orbit mobile communication systems, new orbital resources were being exploited, thus reducing future demand on geostationary orbital slots. It also took note of the regulations adopted by the World Radiocommunication Conference held at Geneva from 27 October to 21 November 1997, which were being implemented by ITU. In particular, the regulatory period available to bring a satellite network into use had been reduced from six years (with the possibility of an automatic extension of up to three years) to five years (with the possibility of an extension of up to two years subject to special conditions). The Subcommittee noted that, together with the requirement to provide a detailed documentation on the proposed network, was intended to substantially limit the submission of fictional "paper" projects and to lead to more efficient and equitable use of geostationary orbital positions and frequencies.

116. The view was expressed that the very positive results of the World Radio Communication Conference that took place at the end of 1997 and, in particular, the decisions taken by ITU on access to frequencies for non-geostationary telecommunication satellite systems would assist all countries, and in particular developing countries, to have access to the most modern telecommunications services.

117. The Subcommittee took note of the working paper submitted by the Czech Republic on the examination of the physical nature and technical attributes of the geostationary orbit; examination of its utilization and applications, including, *inter alia*, in the field of space communications, as well as other questions relating to

space communications developments, taking into particular account the needs and interests of developing countries (A/AC.105/C.1/L.216).

118. The Subcommittee noted that, in the working paper, it was proposed that, to facilitate further deliberations on the item, the following principles, universally accepted by the scientific and technical community, should be applied: (a) the existence of orbits of all satellites, including geostationary satellites, depended mainly on gravitational phenomena generated by the entire body of the Earth; and (b) a geostationary satellite, whether acted upon by natural forces only or by man-made impulses, was not fixed over a point on Earth's equator: between corrective impulses of its station-keeping, it was in a natural flight caused by gravitational as well as non-gravitational forces generated by the Earth, the Sun and the Moon.

119. Some delegations supported the proposals contained in the working paper submitted by the Czech Republic while other delegations stated that they did not agree with those proposals.

120. The view was expressed that there were two ways to maximize the efficiency of the utilization of the geostationary orbit: (a) to replace several satellites by a large-scale integrated satellite platform with a comprehensive capacity for such functions as communication, broadcasting, meteorological and environmental monitoring, thus reducing the number of satellites in orbit; and (b) to use a satellite constellation. In the view of that delegation, by adopting new methods of space and frequency separation, the distance between satellites in orbit could be drastically reduced and, as a result, several satellites could be placed at the same orbital position without them interfering with one another. That delegation also expressed the view that new types of orbits (geosynchronous orbits with a small inclination and the use of solar radiation pressure to keep satellites constantly over a stable point at very low latitude) could be used in the coming millennium in addition to the geostationary orbit.

121. Some delegations expressed the view that the geostationary orbit was a limited natural resource and that saturation should be avoided in order to ensure that all countries had non-discriminatory access to the orbit. Those delegations felt that a special *sui generis* legal regime was required to ensure equitable access by all States, particularly developing countries. They felt that the roles of ITU, which concerned the technical aspects, and of the Committee on the Peaceful Uses of Outer Space with respect to the geostationary orbit were complementary. Other delegations expressed the view that questions relating to the geostationary orbit were being effectively addressed by ITU.

122. The Subcommittee recommended that further consideration of the item be postponed until the year 2000 in view of its abbreviated schedule of work at its thirty-sixth session, in 1999, and the preparatory work to be carried out for UNISPACE III.

VIII. PROGRESS IN NATIONAL AND INTERNATIONAL SPACE ACTIVITIES RELATED TO THE EARTH ENVIRONMENT, IN PARTICULAR PROGRESS IN THE INTERNATIONAL GEOSPHERE-BIOSPHERE (GLOBAL CHANGE) PROGRAMME

123. In accordance with General Assembly resolution 52/56, paragraph 15 (b), the Subcommittee continued its consideration of the item concerning progress in national and international space activities related to the Earth environment, in particular progress in the International Geosphere-Biosphere (Global Change) Programme.

124. The Subcommittee noted the progress being made through international cooperation in the International Geosphere-Biosphere (Global Change) Programme with the participation of many countries. It also noted that such a joint international effort was of fundamental importance for examining the future habitability of the

planet and for managing the common natural resources of Earth. The Subcommittee took particular note of the need to involve as many countries as possible in the scientific activities of the Programme, in both developed and developing countries.

125. The Subcommittee noted that a special two-day symposium entitled "Transformation and Analysis of Space Obtained Geophysical Data for Global Change Studies" would be organized during the Thirty-Second Scientific Assembly of COSPAR, to be held at Nagoya, Japan, in 1998. The aim of the symposium would be to assist developing countries in realizing new possibilities for global change studies currently available through the use of satellite remote sensing data.

126. The Subcommittee took note of the important contributions of satellite remote sensing to environmental monitoring, planning sustainable development, water-resource development, monitoring crop conditions and predicting and assessing drought. The Subcommittee noted the importance of studies related to stratospheric ozone, UV-B radiation and the measurement of aerosols and welcomed cooperation for joint studies and coordination programmes in that area, such as the studies being conducted by Argentina, Brazil and the United States.

127. The Subcommittee noted the important contribution of meteorological and atmospheric research satellites to studying global climate change, the greenhouse effect, the degradation of the ozone layer and other oceanic and global environmental processes. The previously launched oceanographic satellite of CNES/NASA, Topex/Poseidon, the NOAA series, the geostationary operational environmental satellite (GOES) series, Total Ozone Mapping System, RADARSAT, ERS-1 and ERS-2, JERS-1, the Polder mission of France, the Indian Research Satellite series, the Okean series of satellites of the Russian Federation, the Sich 1 satellite of Ukraine and the recently launched TRMM of Japan and the United States, were important tools for that purpose, as would be the planned Phase II Mission to Planet Earth Programme, the Moderate Resolution Imaging Specrometer (MODIS), the satellite Jason-1, the successor of Topex/Poseidon, Envisat, Meteor, Meteosat, NOAA-K, GOES-K and other similar spacecraft. The Subcommittee noted the need for further space research relating to climate change, energy exchange between the atmosphere and land and ocean surfaces, weather patterns, vegetation distribution and other environmental factors.

128. The Subcommittee noted the importance of international cooperation in the various existing and planned satellite systems for environmental monitoring. It recommended that other States should consider participating in such cooperative activities.

129. The Subcommittee recommended that further consideration of the item be postponed until the year 2000 in view of its abbreviated schedule of work at its thirty-sixth session, in 1999, and the preparatory work to be carried out for UNISPACE III.

IX. MATTERS RELATING TO LIFE SCIENCES, INCLUDING SPACE MEDICINE

130. In accordance with General Assembly resolution 52/56, the Subcommittee continued its consideration of the item relating to life sciences.

131. The Subcommittee noted that studies of human and animal physiology under the microgravity conditions of space flight had led to important advances in medical knowledge in such areas as blood circulation, hypertension, osteoporosis, cardiovascular physiology, sensory perception, immunology and the effects of cosmic radiation. It noted the success of the Russian Federation in the field of space medicine and biology and, in particular, new research activities carried out by the Russian Institute of Biomedical Studies and international projects carried out under the aegis of that Institute. It also noted that important new data and other information in those fields had been obtained through experiments on the Mir space station, particularly within the

framework of international cooperation programmes such as EUROMIR, MIR 97 and MIR-NASA, carried out during the flights of ESA, French, German and United States astronauts aboard that space station. Important data had been gathered during several United States Space Shuttle missions, including flights involving Canadian, French and Japanese astronauts. Important data had also been gathered from biological experiments on the BION 11 satellite, launched by the Russian Federation with the participation of experts from Canada, France, Germany, Ukraine and United States. The Subcommittee took note of ground-based activities undertaken by the United States during 1997, including the completion of a 60-day and a 90-day chamber test as part of its Human Test Initiative to study advanced life support systems, and the establishment of two centres, the National Space Biomedical Research Institute and a Commercial Space Centre for Medical Informatics and Technology Applications.

132. The Subcommittee took note of the French-German cooperation in the development of a diagnostic facility for cardiovascular research in space, CARDIOLAB, to be used on the International Space Station, and the development by the space agencies of Bulgaria, Germany and the Russian Federation of a new generation of medical measuring equipment, the Bulgarian Neurolab-B and the automatic biotechnological system SVET, as well as the Hungarian thermoluminescent dosimeter (Pille).

133. The Subcommittee noted that applications of space technologies were demonstrating growing promise in medicine and pub' c health on Earth. In that connection, the Subcommittee noted that specialists from Argentina, Brazil, Chile, China, Costa Rica, Mexico, United States and Uruguay were performing biotechnological experiments consisting of growing many types of protein crystals under microgravity conditions. The proteins could be used to develop new drugs for the control of infectious diseases such as Chagas's disease. The Subcommittee also took note of experiments being conducted by Chilean students to examine, in microgravity conditions, the possibility of using *Eriopas connexa* as a biological disease control mechanism in agriculture in future space stations. The Subcommittee also noted that products of space biotechnology, such as pharmaceutical and medical instruments, could contribute to improved health care. The Subcommittee noted the importance of space technology for those purposes and encouraged further research and exchange of information on those applications.

134. The Subcommittee noted that space studies in life sciences and medicine had important potential benefits for all countries and that efforts should be made to promote international cooperation to enable all countries to benefit from those advances. The Subcommittee heard a special presentation by the delegation of Italy on the implementation work on the tele-education and telemedicine project SHARED, carried out for the benefit of countries in eastern Europe.

135. The Subcommittee recommended that further consideration of the item be postponed until the year 2000 in view of its abbreviated schedule of work at its thirty-sixth session, in 1999, and the preparatory work to be carried out for UNISPACE III.

X. MATTERS RELATING TO PLANETARY EXPLORATION AND MATTERS RELATING TO ASTRONOMY

136. In accordance with General Assembly resolution 52/56, the Subcommittee continued its consideration of the item on planetary exploration and the item on astronomy.

137. The Subcommittee noted that several planetary exploration missions were currently under way. The Galileo spacecraft had successfully accomplished its primary mission near Jupiter and had started a two-year extended scientific investigation of its natural satellite system; the Ulysses spacecraft had continued its investigations of the solar polar regions during its extended mission. The Subcommittee noted the following investigations by the United States: the Mars Global Surveyor, for the global observation of Mars, and the Mars

Pathfinder Mission; the Near-Earth Asteroid Rendezvous (NEAR) mission, for the study and observation of asteroids; Cassini/Huygens, for the investigation of Saturn and its moons; and the Lunar Prospector, for lunar exploration. It also noted missions planned for future launch, including the Stardust and Rosetta missions to asteroids and comets. The Subcommittee noted the considerable contribution of those missions to greatly enlarging the scientific knowledge of the solar system and its origin. The Subcommittee noted the high degree of international cooperation in all of those investigations and stressed the need to further enhance international cooperation in planetary exploration in order to enable all countries to benefit from and participate in those activities.

138. The Subcommittee noted that, in recognition of the relationship between the origin of life and the origin and evolution of planets, NASA had instituted a new astrobiology programme in 1997 that would focus on biological research on the evolution of life on Earth to anticipate the likelihood and nature of life elsewhere in the universe. The Subcommittee also noted that, on the basis of a competitive selection process involving interdisciplinary research teams, an astrobiology institute would be established in 1998.

139. The Subcommittee noted that the use of spacecraft for making astronomical observations from above the atmosphere had greatly advanced the knowledge of the universe by allowing observations in all regions of the electromagnetic spectrum. It noted that astronomers had powerful tools for their investigations of the universe, such as the upgraded Hubble Space Telescope, Rosat, the Compton Gamma Ray Observatory, the Extreme Ultraviolet Explorer, Astro-D, Freja, IRS-P2 and P3, Koronas I, Polar stretched Rohini scientific satellite (SROSS) and Wind satellites, the Beppo SAX astronomy satellite, the Magion 4 and 5 sub-satellites, the Orfeus 2 ultraviolet spectrometer and the recent ASTRO-SPAS sub-satellites. It noted the success of the Russian-led experiments Interball, Koronas and APEX, the work of the Rentgen Kvant Observatory, which was an integral part of the Mir space station, the GRANAT observatory and the Russian scientific instruments, KONUS, installed on the United States Wind satellite, the Infrared Space Observatory, the German small satellite Equator-S, the international Solar and Heliospheric Observatory and the Japanese radioastronomy satellite Halca, as well as the Spartan series of sub-satellites.

140. The Subcommittee noted that the planned launches of the Radioastron satellite, the Spektr-Roentgen-Gamma observatory, the Advanced X-ray Astrophysics Facility, the Space Infrared Telescope Facility, the Spektr-UV, the International Gamma Ray Astronomy Laboratory (INTEGRAL), the Very Long Base Interferometry Space Observatory, the X-ray Multi-Mirror Mission (XMM), a Broad-band Imaging X-ray All-Sky Survey (ABRIXAS), Gamma 1 and 400, Ikon, Relikt 3 and many others would open up further realms of the universe to detailed observation. The Subcommittee noted with satisfaction that all of those projects were open to broad international cooperation.

141. The Subcommittee took note of the ongoing and new programmes for ground-based astronomical observations, particularly in Brazil, Canada, India, Italy, Russian Federation and United States. In particular, it noted that the Global Oscillations Network Group (GONG) instrument for observing solar global oscillations had been operating at Udaipur Solar Observatory in India since October 1995. It also noted the international cooperative effort to develop the Airborne Stratospheric Observatory for Infrared Astronomy (SOFIA). The Subcommittee further noted that the increase in space debris and radio noise, as well as recent proposals for promotional and commemorative use of outer space, posed a real threat to ground-based astronomy. The Subcommittee noted the need to minimize the impact of space activities on astronomical observations.

142. The Subcommittee noted the success of the Pronaos mission of CNES in the area of submillimetric astronomy and the important results obtained during the course of its flight on a stratospheric balloon in September 1996. It also noted that the next flight was scheduled to take place in 1998.

143. The Subcommittee recommended that further consideration of the item be postponed until the year 2000 in view of its abbreviated schedule of work at its thirty-sixth session, in 1999, and the preparatory work to be carried out for UNISPACE III.

XI. THEME FIXED FOR SPECIAL ATTENTION AT THE 1998 SESSION: SCIENTIFIC AND TECHNICAL ASPECTS AND APPLICATIONS OF SPACE-BASED METEOROLOGY

144. In accordance with General Assembly resolution 52/56, the Subcommittee paid special attention to the theme "Scientific and technical aspects and applications of space-based meteorology". The Subcommittee noted with satisfaction that, at its invitation, COSPAR and IAF had organized on 9 and 10 February 1998 a symposium on the theme, as described in paragraphs 15 and 16 of the present report.

145. The Subcommittee noted that satellite meteorology had brought a new way of monitoring the global climate and detecting its changes, offering the tools for systematic acquisition of global information on a variety of meteorological parameters. It also noted that many important activities, such as agriculture, construction, transportation and tourism, were influenced by the weather and benefited from the data and forecast and warning guidance derived from satellite observations. It further noted that the most obvious benefit was the protection of life and property by, for example, detecting, tracking and predicting severe storms and other extreme and adverse weather conditions.

146. The Subcommittee noted that the space-based part of the global observing system consisted of at least three low Earth polar orbit satellites and six geostationary satellites provided by the cooperating countries. It also noted that that system, which continued to evolve and grow, was capable of detecting at the earliest stages the development and movement of most major cyclones and storms on a global basis. In particular, climatic changes and natural phenomena, such as seasonal monsoons in east Asia and El Niño, were being monitored and studied so that urgent mitigation measures could be taken. The Subcommittee further noted that, in order to derive maximum benefit from the applications of space-based meteorology, a high level of international cooperation and the free exchange of information were needed.

147. The Subcommittee noted that satellites were particularly suited to delivering locale-specific disaster warning and communications to remote, rural and underdeveloped areas. In particular, it noted the extensive use of meteorological satellites to that end in China and India and their operational use to provide objective assessments of weather information, land-cover monitoring and forest fire outbreaks in Brazil. Data obtained using those satellites also formed a basis for studying and monitoring the vegetation cover and forest depletion in order to understand their effects on global change processes. The Subcommittee also noted the possibility of linking remote sensing, meteorological and geographical information systems to develop a global information infrastructure that could offer viable solutions to many problems related to disaster management.

148. The Subcommittee recommended that further consideration of the item be postponed until the year 2000 in view of its abbreviated schedule of work at its thirty-sixth session, in 1999, and the preparatory work to be carried out for UNISPACE III.

XII. OTHER MATTERS

A. Implementation of the recommendations of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space

149. In accordance with General Assembly resolution 52/56, paragraph 17, the Subcommittee reconvened the Working Group of the Whole to conclude its evaluation of the recommendations of UNISPACE 82. The Working Group of the Whole was chaired by Muhammed Nasim Shah (Pakistan); it held 9 meetings, between 10 and 19 February 1998, and adopted its report on 19 February 1998.

150. Having considered the report of the Working Group of the Whole, the Subcommittee decided at its 513th meeting, on 19 February 1998, to adopt that report as contained in annex II to the present report. The conclusions of the Working Group of the Whole are contained in paragraphs 3 to 12 of its report.

B. Review of the future work of the Scientific and Technical Subcommittee

151. The Subcommittee recalled that the General Assembly, in its resolution 52/56, had endorsed the new measures relating to the working methods of the Committee and its subsidiary bodies, including those concerning the duration and pattern of meetings that would apply to the sessions of the Committee and its subsidiary bodies. The Subcommittee recalled, in particular, that the exact schedule would be confirmed by the Committee at its forty-first session, in 1998, and would depend on the progress to be made in the preparations for UNISPACE III and the agreement, to be reached at the thirty-fifth session of the Subcommittee, on which of its agenda items would be considered at its thirty-sixth session, in 1999.

152. The Subcommittee recommended that the agenda for its thirty-sixth session should include the following priority items:

(a) Preparations for the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III), by the Advisory Committee for UNISPACE III;

(b) Space debris;

(c) Consideration of the United Nations Programme on Space Applications and the coordination of space activities within the United Nations system.

153. The Subcommittee recommended that further consideration of the following items should be suspended for one year, to be resumed at its thirty-seventh session, in the year 2000:

(a) General exchange of views;

(b) Matters relating to the remote sensing of Earth by satellite, including applications for developing countries, to be considered on a priority basis;

(c) Use of nuclear power sources in outer space, to be considered on a priority basis;

(d) Questions relating to space transportation systems and their implications for future activities in outer space;

(e) Examination of the physical nature and technical attributes of the geostationary orbit and of its utilization and applications, including in the field of space communications, as well as other questions relating

to space communications developments, taking particular account of the needs and interests of developing countries;

(f) Matters relating to life sciences, including space medicine;

(g) Progress in national and international space activities related to the Earth's environment, in particular progress in the International Geosphere-Biosphere (Global Change) Programme;

(h) Matters relating to planetary exploration;

(i) Matters relating to astronomy;

(j) Consideration of the theme fixed for special attention at the Scientific and Technical Subcommittee.

154. The Subcommittee recalled that at its 36th session, in 1997, it had agreed that the schedule of work for 1999 would be confirmed by the Committee at its 41st session, in 1998, depending on the progress made in the preparations for UNISPACE III and the agreement reached at the current session of the Subcommittee as to which of its agenda items should be considered at its 42nd session, in 1999 (A/AC.105/672, para. 160).

155. The Subcommittee agreed that, regarding the item in paragraph 153 (j) above, it should identify, at its thirty-sixth session, the theme for special attention at its thirty-seventh session. The Subcommittee recommended that COSPAR and IAF, in liaison with Member States, should be invited to arrange a symposium with as wide a participation as possible, to be held during the first week of the thirty-seventh session, in order to complement discussions by the Subcommittee on the special theme.

C. Other reports

156. The Subcommittee welcomed the annual reports of ESA (A/AC.105/694), EUMETSAT (A/AC.105/695) and INTELSAT (A/AC.105/696). The Subcommittee requested those organizations to continue to report on their work.

157. The Subcommittee expressed its appreciation to COSPAR for its report on the progress in space research and to IAF for its report on space technology and applications, the two reports being compiled by the Office for Outer Space Affairs of the Secretariat and issued jointly under the title *Highlights in Space: Progress in Space Science, Technology and Applications, International Cooperation and Space Law, 1997* (A/AC.105/691 and Corr.1).

158. One delegation expressed its serious concern about an error in the publication entitled *Highlights in Space: Progress in Space Science, Technology and Applications, International Cooperation and Space Law, 1997*. That delegation requested the Office for Outer Space Affairs to take effective measures to correct the error as soon as possible and to ensure that no such error would occur in the future. The Subcommittee noted that the Office for Outer Space Affairs had taken certain measures to correct the error and that a corrigendum had been issued during the current session.

159. The Subcommittee noted with appreciation the participation in its current session of representatives of United Nations bodies and specialized agencies and permanent observers and found their statements and reports helpful in enabling it to fulfil its role as focal point for international cooperation in space.

Notes

[1]*Official Records of the General Assembly, Fifty-second Session, Supplement No. 20* (A/52/20).

[2]Ibid., annex I, para. 4.

[3]*Official Records of the General Assembly, Fifty-second Session, Supplement No. 20* (A/52/20).

[4]*Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 3-14 June 1992* (United Nations publication, Sales No. E.93.I.8 and corrigenda), vol. I: *Resolutions Adopted by the Conference*, resolution 1, annex II.

[5]*Official Records of the General Assembly, Fifty-second Session, Supplement No. 20* (A/52/20), para. 78.

[6]Ibid., para. 79.

[7]United Nations, *Treaty Series*, vol. 1439, No. 24404.

[8]Ibid., vol. 1457, No. 24643.

Annex I

DOCUMENTS BEFORE THE SCIENTIFIC AND TECHNICAL SUBCOMMITTEE AT ITS THIRTY-FIFTH SESSION

Item 2. Adoption of the agenda

A/AC.105/C.1/L.215	Provisional agenda, with annotations, for the thirty-fifth session

Item 5. United Nations Programme on Space Applications and the coordination of space activities within the United Nations system

A/AC.105/693 and Corr.1 and Add.1	Report of the Expert on Space Applications
A/AC.105/667	Applications of space communications technology to distance education
A/AC.105/678	Report on the Seventh United Nations International Training Course on Remote Sensing Education for Educators (Stockholm and Kiruna, Sweden, 5 May-13 June 1997)
A/AC.105/682	Report on the Seventh United Nations/European Space Agency Workshop on Basic Space Science (Tegucigalpa, 16-20 June 1997)
A/AC.105/683	Report on the United Nations/European Space Agency Symposium on Space Industry Cooperation with the Developing World (Graz, Austria, 8-11 September 1997)
A/AC.105/684	Report of the United Nations Workshop on Space Communications Technology for Capacity Building (Haifa, Israel, 21-25 September 1997)
A/AC.105/686	Report on the United Nations/International Astronautical Federation Workshop on Space Technology as a Cost-effective Tool to Improve Infrastructures in Developing Countries (Turin, Italy, 2-5 October 1997)
A/AC.105/687	Report on the United Nations/European Space Agency/Committee on Space Research Workshop on Data Analysis Techniques (São José dos Campos, Brazil, 10-14 November 1997)
A/AC.105/688	Report on the Fourth United Nations/European Space Agency Training Course for Experts from English-speaking African Countries on Applications of the European Remote Sensing Satellite Data to Natural Resources, Renewable Energy and the Environment (Frascati, Italy, 24 November-5 December 1997)
A/AC.105/692	List of the activities sponsored by the United Nations Programme on Space Applications from 1971 to 1997

Item 6. Preparations for the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) by the Advisory Committee for UNISPACE III

A/AC.105/685 and Corr.1	Organizational matters relating to the holding of UNISPACE III
A/AC.105/C.1/L.218	Draft report for the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space

Item 8. Use of nuclear power sources in outer space

A/AC.105/C.1/L.220	Collisions of nuclear power sources with space debris: working paper submitted by the Russian Federation
A/AC.105/C.1/L.222	Work plan for developing a framework for safety assurance processes and standards for nuclear power sources in outer space: working paper submitted by the Russian Federation, the United Kingdom of Great Britain and Northern Ireland and the United States of America
A/AC.105/C.1/L.223	Use of nuclear power sources in outer space: working paper submitted by the Russian Federation

Item 9. Space debris

A/AC.105/680 and Add.1	National research on space debris; safety of nuclear-powered satellites; and problems of collisions of nuclear-powered sources with space debris
A/AC.105/681	Steps taken by space agencies for reducing the growth or damage potential of space debris
A/AC.105/C.1/L.217	Space debris: working paper submitted by the International Academy of Astronautics
A/AC.105/C.1/L.219	Space debris: working paper submitted by the Russian Federation
A/AC.105/C.1/L.224	Revisions to the technical report on space debris of the Scientific and Technical Subcommittee

Item 11. Examination of the physical nature and technical attributes of the geostationary orbit and of its utilization and applications, including, *inter alia*, in the field of space communications, as well as other questions relating to space communications developments, taking particular account of the needs and interests of developing countries

A/AC.105/C.1/L.216	Examination of the physical nature and technical attributes of the geostationary orbit; examination of its utilization and applications, including, *inter alia*, in the field of space communications, as well as other questions relating to space communications developments, taking particular account of the needs and interests of developing countries: working paper submitted by the Czech Republic

Item 17. Other matters

A/AC.105/679 and Add.1 and.2	Implementation of the recommendations of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space: International cooperation in the peaceful uses of outer space: activities of Member States
A/AC.105/691 and Corr.1	Highlights in Space: Progress in Space Science, Technology and Applications, International Cooperation and Space Law, 1997
A/AC.105/694	Report of the European Space Agency
A/AC.105/695	Report of the European Organisation for the Exploitation of Meteorological Satellites
A/AC.105/696	Report of the International Telecommunication Satellite Organization

Item 18. Report to the Committee on the Peaceful Uses of Outer Space

A/AC.105/C.1/L.221 and Add.1-4	Draft report of the Scientific and Technical Subcommittee on the work of its thirty-fifth session

Working Group of the Whole to Evaluate the Implementation of the Recommendations of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space

A/AC.105/C.1/WG.6/L.13 and Add.1	Draft report of the Working Group of the Whole to Evaluate the Implementation of the Recommendations of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space on the work of its twelfth session

Working Group on the Use of Nuclear Power Sources in Outer Space

A/AC.105/C.1/WG.5/L.34	Draft report of the Working Group on the Use of Nuclear Power Sources in Outer Space on the work of its fifteenth session

Annex II

REPORT OF THE WORKING GROUP OF THE WHOLE TO EVALUATE THE IMPLEMENTATION OF THE RECOMMENDATIONS OF THE SECOND UNITED NATIONS CONFERENCE ON THE EXPLORATION AND PEACEFUL USES OF OUTER SPACE (UNISPACE 82) ON THE WORK OF ITS TWELFTH SESSION

1. In accordance with paragraph 17 of General Assembly resolution 52/56, the Working Group of the Whole to Evaluate the Implementation of the Recommendations of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE 82) was reconvened for its twelfth session at the thirty-fifth session of the Scientific and Technical Subcommittee (a) to conclude its evaluation of the implementation of the recommendations of UNISPACE 82 and (b) to assist the Advisory Committee in its preparatory work for the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III). The Working Group of the Whole held a series of meetings from 10 to 19 February 1998. At its meeting on 19 February 1998, it adopted the present report.

2. Muhammad Nasim Shah (Pakistan) was elected Chairman of the Working Group of the Whole. The Chairman, in his opening remarks, reviewed the mandate of the Working Group of the Whole for its twelfth session.

I. CONCLUSION OF THE EVALUATION OF THE IMPLEMENTATION OF THE RECOMMENDATIONS OF UNISPACE 82

3. The Working Group of the Whole recalled that UNISPACE 82 had been convened at Vienna from 9 to 21 August 1982. Its purpose had been to exchange information and experiences on recent developments in space and to assess such developments and the adequacy and effectiveness of institutional and cooperative means of realizing the benefits of space technology. UNISPACE 82 had been attended by the representatives of 94 Member States; 45 intergovernmental and non-governmental organizations had been represented by observers. Consideration had been given to three primary subjects: (a) the state of space science and technology; (b) applications of space science and technology; and (c) international cooperation and the role of the United Nations. The recommendations of UNISPACE 82, which had been adopted by consensus, were contained in its report.[a]

4. The Working Group of the Whole also recalled that the General Assembly, in its resolution 37/90, had endorsed the recommendations of UNISPACE 82 pertaining to international cooperation in the exploration and peaceful uses of outer space, had invited all Governments to implement the recommendations and had requested all organs, organizations and bodies of the United Nations system and other relevant intergovernmental organizations to cooperate in their implementation. The adoption of Assembly resolution 37/90 had resulted in the following: (a) the United Nations and other organizations had conducted studies of existing and proposed space activities and their implications; (b) the United Nations Programme on Space Applications had been strengthened, expanded and directed towards a number of objectives specified by UNISPACE 82; and (c) an International Space Information Service had been established.

5. The Working Group of the Whole further recalled that the General Assembly, in its resolution 41/64, had endorsed the recommendation of the Committee on the Peaceful Uses of Outer Space that the Scientific and Technical Subcommittee, beginning with its twenty-fourth session, should establish a Working Group of the Whole to evaluate the implementation of the recommendations of UNISPACE 82, with a view to improving

the execution of activities relating to international cooperation, particularly those included in the United Nations Programme on Space Applications, and to propose concrete steps to increase such cooperation as well as to make it more efficient.

6. The Working Group of the Whole noted with appreciation that the United Nations and its specialized agencies, Member States through their national space agencies, relevant intergovernmental and non-governmental organizations and other space-related organizations, including the private sector, had contributed to the implementation of the recommendations of UNISPACE 82.

7. The Working Group of the Whole also noted that the recommendations that it had made since 1987 had focused the attention of the international community on a number of issues of particular importance to promoting the access to and use of space technology by all Member States, particularly for developing countries.

8. In carrying out its mandate, the Working Group of the Whole had refined or interpreted several recommendations of UNISPACE 82, making them more specific to facilitate their implementation. As a result, good progress had been achieved, notably in the following areas:

(a) Arrangement of a fellowship programme for the organization of in-depth training courses and workshops by the Office for Outer Space Affairs on advanced applications of space science and technology;

(b) Enhancement in international and regional cooperation in the light of the continued development of worldwide space activities;

(c) Preparation of a series of technical studies relating to specific areas of space science, space technology and their applications, having in view the relevance of those studies to the international space activities as well as the needs of developing countries;

(d) Promotion of a greater exchange of actual experiences and cooperation in space science and technology;

(e) Establishment of regional centres for space science and technology education in each economic region, in order to stimulate the growth of indigenous nuclei and an autonomous technological base in space technology in developing countries;

(f) Efforts to arrange for appropriate allocations from the United Nations budget for the expanded activities of the United Nations Programme on Space Applications and for requesting Member States to support the Programme through voluntary contributions, both in cash and in kind.

9. The Working Group of the Whole noted with satisfaction that it had been instrumental in the conceptual development and planning of UNISPACE III and had contributed effectively to the detailed preparatory work for the Conference (including objectives, form, venue, date, participants, sharply focused agenda with annotations, financial aspects and additional components of the Conference) entrusted to the Working Group of the Whole by the Scientific and Technical Subcommittee in its capacity as Advisory Committee.

10. The Working Group of the Whole also noted with satisfaction that, on the basis of its recommendations, which had been adopted by the Advisory Committee, the Committee on the Peaceful Uses of Outer Space at its fortieth session, in June 1997, had been able to finalize its recommendations for holding UNISPACE III.

11. The Working Group of the Whole also noted that some of the recommendations not involving substantial financial implications had been fully implemented. Others had been partially implemented and might require

further consideration in order to determine whether they should be made more specific and considered for further action within the context of UNISPACE III.

12. Pursuant to General Assembly resolution 52/56, the Working Group of the Whole concluded its work on the evaluation of the implementation of the recommendations of UNISPACE 82 so that it could assist the Advisory Committee in its preparatory work for UNISPACE III.

II. THIRD UNITED NATIONS CONFERENCE ON THE EXPLORATION AND PEACEFUL USES OF OUTER SPACE (UNISPACE III)

13. The Working Group of the Whole noted that the General Assembly, in its resolution 52/56, had agreed that the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) should be convened at the United Nations Office at Vienna from 19 to 30 July 1999 as a special session of the Committee on the Peaceful Uses of Outer Space, open to all States Members of the United Nations, and had requested the Preparatory and Advisory Committees and the executive secretariat to carry out their tasks in accordance with the recommendations of the Preparatory Committee at its 1997 session[b] and to report to the Assembly at its fifty-third session.

14. The Working Group of the Whole also noted that the Advisory Committee had requested it to give full consideration to the tasks entrusted to the Advisory Committee by the General Assembly.

A. Preparation of the draft report of UNISPACE III

15. The Working Group of the Whole recalled the agreement of the Preparatory Committee at its 1997 session that, to develop the report for UNISPACE III, the secretariat would provide an initial draft in time for the 1998 session of the Advisory Committee.[c] The Working Group noted that, pursuant to that agreement, the secretariat had prepared a document (A/AC.105/C.1/L.218) containing elements to be considered for inclusion in the full draft report. The Working Group was informed by the secretariat that the document would be revised and that a first full text of the draft report would be prepared for consideration by the Preparatory Committee at its 1998 session, based on the comments provided during the 1998 session of the Advisory Committee.

16. The Working Group of the Whole conducted a section-by-section consideration of the text contained in the document prepared by the secretariat (A/AC.105/C.1/L.218) and provided detailed comments concerning the structure and content of the text. The Working Group requested that, on the basis of those comments, the secretariat should prepare the first full draft report for paragraph-by-paragraph consideration by the Preparatory Committee. The Working Group recommended that the secretariat should circulate the first full draft report to Member States of the Committee on the Peaceful Uses of Outer Space well ahead of the 1998 session of the Preparatory Committee.

B. Organization of UNISPACE III

17. The Working Group of the Whole recalled the agreement of the Preparatory Committee that the Advisory Committee, at its 1998 session, should agree on an indicative schedule of events to be held prior to and during UNISPACE III, including the additional components of the Conference, taking into consideration, among others, the input provided by space agencies and international organizations. At its 1997 session, the Preparatory Committee had also requested the secretariat to prepare, in time for the 1998 session of the Advisory Committee, an indicative schedule of those events, including the distribution of agenda items between its two committees, the participation of international organizations and industry, technical presentations, poster sessions, evening lectures, an exhibition and other related aspects of the Conference, for consideration by the

Advisory Committee. The Working Group noted that, pursuant to that request, the secretariat had submitted to the Advisory Committee a report on organizational matters relating to the holding of UNISPACE III (A/AC.105/685 and Corr.1), which contained the information requested by the Preparatory Committee.

18. On the basis of its deliberations, the Working Group of the Whole made recommendations concerning the organization of UNISPACE III. Those recommendations are presented below.

1. Establishment of main committees and the composition of the bureau

19. The Working Group of the Whole agreed that the Conference should consist of the Plenary, Committee I and Committee II. The Working Group also agreed that a technical forum would be established as a technical body of the Conference consisting of technical presentations relating to the agenda of the Conference, as well as additional components of the Conference, such as workshops and seminars, poster sessions, a space exhibition and public evening lectures.

20. The Working Group of the Whole agreed that the bureau of the Conference should consist of the following 10 officers: Chairman, First Vice-Chairman and Second Vice-Chairman/Rapporteur of the Plenary; Chairman, Vice-Chairman and Rapporteur of Committee I; Chairman, Vice-Chairman and Rapporteur of Committee II; and Chairman of the Technical Forum.

21. The Working Group of the Whole recommended that the current bureau of the Committee on the Peaceful Uses of Outer Space continue as members of the bureau of the Conference in their current functions. The Working Group also recommended that the chairmen of the Scientific and Technical Subcommittee and the Legal Subcommittee of the Committee be included as members of the bureau of the Conference. The Working Group further recommended that the other five officers should be elected from among the representatives of the States participating in the Conference on the basis of equitable geographical distribution. Thus, one officer would be selected from each of the following regional groups: Africa; Asia and the Pacific; eastern Europe; Latin America and the Caribbean; and western Europe and other States.

22. The Working Group of the Whole agreed that the Rapporteur of the Plenary would be responsible for presenting the full draft report of UNISPACE III to the plenary. The Working Group recommended that each regional group designate two persons to assist the Rapporteur in compiling the final draft report of the Conference, based on decisions of the committees of the Conference. The Working Group noted that the substantive parts of the draft versions of the report of the Conference, including a plan of action, would be prepared by the executive secretariat, and would be considered by the Advisory Committee and the Preparatory Committee. The Working Group also agreed that the Rapporteur could invite additional representatives of Member States to assist him in carrying out his task of preparing the full draft report for adoption by the plenary.

2. Consideration of agenda items

23. The Working Group of the Whole noted that the allocation of substantive agenda items between Committee I and Committee II as recommended by the Advisory Committee at its 1997 session, as described in annex II of the report of the Scientific and Technical Subcommittee on the work of its thirty-fourth session, in 1997 (A/AC.105/672), was not optimal in the sense of time utilization. The Working Group recommended that further consideration be given to an alternative scenario for the allocation of substantive agenda items between the Plenary, Committee I and Committee II by the Preparatory Committee at its 1998 session, when it would have before it the first full draft report of UNISPACE III.

24. The Working Group of the Whole agreed that, while all substantive agenda items would be considered by Committee I or Committee II, some items, to be identified by the Preparatory Committee, could also be

considered through workshops. The workshops could consider such items under which highly technical or scientific discussions could be expected and reports would be made on the status of international programmes or initiatives involving space science and technology and their applications. The purpose of holding such workshops would be to increase the awareness of policy and decision makers of the importance of space activities in protecting the environment and in promoting economic and social development. The Working Group noted that all substantive agenda items would remain on the agendas of Committee I and Committee II, which would receive any reports submitted by the workshops for their possible consideration.

25. The Working Group of the Whole further agreed that such workshops could be organized by interested international organizations or space-related industry invited to attend UNISPACE III. Noting that the secretariat would provide the Preparatory Committee at its 1998 session with an updated list of workshops to be organized by interested organizations, the Working Group recommended that the Preparatory Committee at that session consider which substantive agenda items could be further discussed in which workshops.

3. Participation of international organizations and industry

International organizations having permanent observer status with the Committee on the Peaceful Uses of Outer Space

26. The Working Group of the Whole agreed that intergovernmental and non-governmental organizations having observer status with the Committee on the Peaceful Uses of Outer Space could deliver general statements in the Plenary. The statements by those organizations should not exceed 7 minutes. The full text of the statements could be circulated in writing.

27. The Working Group of the Whole also agreed that those organizations might also circulate papers in the Plenary and Committee I and Committee II during their consideration of substantive agenda items, under sub-items 7 (a)-(e) of the provisional agenda (A/AC.105/672, annex II). Time permitting, the chairpersons of the Plenary, Committee I and Committee II could provide those organizations with opportunities to make statements on substantive items and participate in the discussions.

28. The Working Group of the Whole further agreed that the intergovernmental and non-governmental organizations having observer status with the Committee could submit their papers prior to the Conference, together with an abstract, 1-2 pages long, in one of the official languages of the United Nations. The abstracts would be translated and issued in all official languages. The papers of those organizations should be submitted to the executive secretariat in a sufficient number of copies for distribution to the Conference and would be circulated in the languages in which they had originally been submitted. In order to ensure their timely circulation, abstracts should be submitted to the executive secretariat before 1 April 1999.

International organizations not having observer status with the Committee

29. The Working Group of the Whole agreed that international organizations not having observer status with the Committee, including intergovernmental and non-governmental organizations, could submit their general statements in writing to the Plenary.

30. The Working Group of the Whole also agreed that those organizations might also circulate papers in the Plenary, Committee I and Committee II during their consideration of substantive agenda items, under sub-items 7 (a)-(e) of the provisional agenda (A/AC.105/672, annex II). Those organizations specifically called upon to prepare reports to the Conference, in accordance with the provisional agenda, might circulate those papers.

31. The Working Group of the Whole further agreed that the papers submitted by organizations not having observer status would be circulated in the languages in which they had originally been submitted. Those organizations should ensure that a sufficient number of copies of their papers would be submitted to the secretariat for distribution to the Conference.

Space-related industry

32. The Working Group of the Whole agreed that the purpose of inviting space-related industry was to disseminate information among participating States on available products and services, as well as plans for products and services for the space segment and for other users for peaceful purposes. The Working Group recommended that Member States consider including representatives of industry as observers in their delegations to UNISPACE III.

33. The Working Group of the Whole recommended that space-related industries be invited to make presentations at workshops and seminars organized in conjunction with the Conference. The Working Group agreed that workshops and seminars might be organized in order to accommodate such presentations on the activities of industry, including available services and products of particular interest to developing countries. The Working Group agreed that, depending on the number of presentations to be made, the time allocated to each presentation could be limited to 20-30 minutes and that the technical presentations could take place throughout the Conference period.

34. The Working Group of the Whole agreed that a limited number of space-industry round tables could be organized, with the participation of high-level representatives of industry (e.g. chief executive officers, chief financial officers, chief operational officers and presidents) and heads or high-ranking officials of space agencies, in order to exchange various ideas and information, to express concerns and requirements that industry might have and to identify products and services that might meet the needs of the countries or regions concerned. The Working Group also agreed that one round table per day could be scheduled at a time that most delegates, including government representatives, could attend.

35. The above-mentioned activities, technical presentations and space-industry round tables would constitute one segment of the Technical Forum, suggested in the report of the Secretariat on organizational matters relating to the holding of UNISPACE III (A/AC.105/685 and Corr.1, para. 29). An extension to that segment of the Conference would be the space exhibition, where those interested in specific products and services could obtain further information from representatives of industry and establish contacts with them for follow-up action.

Other remarks

36. The Working Group of the Whole recommended that all the intergovernmental and non-governmental organizations having observer status with the Committee, international organizations not having observer status with the Committee and space-related industries should be encouraged to participate in those activities organized as additional components of the Conference and to make technical presentations. The Working Group noted that, in accordance with the agreement of the Preparatory Committee at its 1997 session and as reflected in the report of the Committee,[4] those organizations and industries had also been invited to participate in activities prior to the Conference, including regional preparatory conferences.

37. The Working Group of the Whole also recommended that consideration be given to the participation of national non-governmental organizations involved in space activities. The modality of their participation could be similar to that of international organizations not having observer status with the Committee.

38. The Working Group of the Whole further recommended that a list be prepared of organizations and space-related industries to be invited to UNISPACE III. The secretariat would prepare such a list, in time for the approval of the Preparatory Committee at its 1998 session, on the understanding that, if agreement was reached, any other organizations and industries would be added to the list at the 1999 session of the Advisory Committee. Accordingly, the Working Group recommended that all Member States should be invited to provide the secretariat, by 15 April 1998, with names of organizations and industries to be included in the list.

4. Rules of procedure

39. The Working Group of the Whole recommended that draft provisional rules of procedure be prepared by the executive secretariat in time for consideration by the Preparatory Committee at its 1998 session. The Working Group further recommended that the Preparatory Committee, at its 1998 session, agree on the provisional rules of procedure for approval by the General Assembly at its fifty-third session.

5. Space exhibition

40. The Working Group of the Whole welcomed the offer of the American Institute of Aeronautics and Astronautics (AIAA) to coordinate the organization of the space exhibition and agreed that AIAA should assist the executive secretariat in holding the space exhibition. The Working Group also noted that, while proceeding to make preliminary arrangements for the exhibition, AIAA would establish an open-ended group of interested exhibitors, including the executive secretariat and Austria as host country, to assist in preparing a concept for the exhibition prior to the 1998 session of the Preparatory Committee. The Working Group further recommended that the Preparatory Committee at its 1998 session be informed of the progress made in organizing the space exhibition.

6. Public evening lectures

41. The Working Group of the Whole agreed that Member States should assist the executive secretariat in identifying speakers among eminent scientists and other experts for the public evening lectures on various subjects of broad interest to participants of UNISPACE III and the general public. While noting that any interpretation services should be provided through voluntary contributions, the Working Group requested that the executive secretariat provide Member States, in time for the 1998 session of the Preparatory Committee, with cost estimates for interpretation services for the public evening lectures.

7. Regional preparatory meetings

42. The Working Group of the Whole noted that if consensus recommendations were adopted at the regional preparatory meetings affecting solely the regional concerns, those recommendations would be considered by the Advisory Committee at its 1999 session for inclusion in the draft report of the Conference. The Working Group understood that any other recommendations that might be of interest for consideration at UNISPACE III would be brought up by interested Member States at the 1999 session of the Advisory Committee.

C. Future work of the Working Group of the Whole

43. In accordance with General Assembly resolution 52/56, the Working Group of the Whole agreed that it should continue to assist the Advisory Committee at its 1999 session.

Notes

[a]*Report of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space, Vienna, 9-21 August 1982* (A/CONF.101/10 and Corr.1 and 2).

[b]*Official Records of the General Assembly, Fifty-second Session, Supplement No. 20* (A/52/20), paras. 150-161.

[c]Ibid, para. 157.

[d]Ibid, para. 153.

Annex III

REPORT OF THE WORKING GROUP ON THE USE OF NUCLEAR POWER SOURCES IN OUTER SPACE ON THE WORK OF ITS FIFTEENTH SESSION

1. The Working Group on the Use of Nuclear Power Sources in Outer Space held its fifteenth session at Vienna from 17 to 19 February 1998 under the chairmanship of Dietrich Rex (Germany) during the thirty-fifth session of the Scientific and Technical Subcommittee.

2. The Working Group had before it working papers submitted by the Russian Federation on collisions of nuclear power sources with space debris (A/AC.105/C.1/L.220) and on the use of nuclear power sources in outer space (A/AC.105/C.1/L.223). The Working Group also had before it a working paper (A/AC.105/C.1/L.222) submitted jointly by the Russian Federation, the United Kingdom and the United States on a work plan for developing a framework for safety assurance processes and standards for nuclear power sources in outer space (see appendix).

3. The Working Group agreed that the four-year work plan constituted a basis for establishing a process and framework for developing data or other information that would facilitate future discussion on nuclear power source safety processes and standards.

4. The Working Group recommended that the work plan and its proposed schedule be adopted by the Subcommittee and that, as a first step, the Secretariat should invite Member States and international organizations to submit information on the following topics, to be considered in 2000 and 2001:

(a) Identification of terrestrial processes and technical standards that may be relevant to nuclear power sources, including factors that distinguish nuclear power sources in outer space from terrestrial nuclear applications;

(b) Review of national and international processes, proposals and standards and national working papers relevant to the launch and peaceful use of nuclear power sources in outer space.

5. The view was expressed that, although the joint working paper contained an acceptable work plan, the plan should also eventually take into consideration radioactive pollution of other celestial bodies, including the Moon.

6. The Working Group held three meetings, between 17 and 19 February 1998. It adopted the present report at its meeting held on 19 February 1998.

7. The Working Group recommended that it be reconvened in the year 2000 to continue its work.

Appendix

WORK PLAN FOR DEVELOPING A FRAMEWORK FOR SAFETY ASSURANCE PROCESSES AND STANDARDS FOR NUCLEAR POWER SOURCES IN OUTER SPACE

Proposal submitted by the Russian Federation, the United Kingdom of Great Britain and Northern Ireland and the United States of America

At the thirty-fourth session of the Scientific and Technical Subcommittee, it was agreed to reconvene the Working Group on the Use of Nuclear Power Sources in Outer Space in 1998 to identify and study the current international technical standards pertinent to the use of nuclear power sources. At the same time, the view was expressed that it would be worthwhile to consider the possibility of formulating a work plan for discussions on the subject (A/AC.105/672, paras. 69-87).

In this regard, the co-sponsors of this proposed work plan wish to offer the schedule of work presented below for establishing a process and framework for developing information or data that will facilitate future discussions of nuclear power source safety processes and standards. This review will be conducted to provide for the broadest range of existing and future radioisotope and reactor nuclear power applications. The objectives of future discussions on nuclear power sources should be: (a) to identify current national and international processes and standards (space and terrestrial related) pertinent to the use of nuclear power sources; and (b) to develop a relevant database as a source for item (a) information concerning nuclear power sources, including the report of the Working Group on the work of its third session, held in 1981 (A/AC.105/287, annex II). The Working Group should draw on the expertise of Member States as well as international organizations such as the International Atomic Energy Agency and the International Commission on Radiological Protection.

Schedule of work

1998: Adopt a schedule of work and invite Member States and international organizations to submit information to the United Nations on topics for the years 2000 and 2001.

2000: Identify terrestrial processes and technical standards that may be relevant to nuclear power sources, including factors that distinguish nuclear power sources in outer space from terrestrial nuclear applications.

2001: Review national and international processes, proposals and standards and national working papers relevant to the launch and peaceful use of nuclear power sources in outer space.

2002: Prepare a report which provides the information to the Scientific and Technical Subcommittee.

2003: Scientific and Technical Subcommittee to determine whether or not to take any additional steps concerning the information in the report of the Working Group.